

# LESSON 10:

## KEY GRABBER

### SUPPLIES

#### MAIN BIN

- Masking Tape (2)
- Toothpicks (75)
- Rubber band (30)
- Bendy Straws (15)
- Boba Straws (90)

#### PENCIL BOX


- Ping pong balls
- Scissors

### OBJECTIVES

- Create an extendable arm grabber to retrieve an object
- Foster creativity, critical thinking, and problem-solving skills.




### HOOK

 3-5 min

- Calling all agents! The keycard used to access the Secret Agent Academy during off-hours has been reported missing by a janitorial staff member who claims to have put it away last night.
- The spy discovery team needs go through the base to try to find it. You follow the signal connected to the key to the spy kitchen, and see the key inside one of a narrow jar. You have to get it out! Ask students to share with they could use to reach into a narrow jug if their hands couldn't fit.

### INTRODUCTION

 3 min

Welcome, back agents! As you know, spy missions often require agents to retrieve important items or information from tight or inaccessible spaces without being detected. To accomplish this, agents rely on a variety of tools and gadgets designed for stealth.

One common tool used in such missions is the extendable grabber. Have you ever played the arcade game where a large mechanical grabber is lowered to try to pick up a toy or stuffed animal? This spy tool is very similar to this grabber machine. It allows agents to reach into narrow or confined spaces to retrieve objects. Today, agent Gizmo will assist us in the construction of a grabber gadget!

### MEET TODAY'S SECRET AGENT



#### Specialty: Gadget Invention

Agent Gizmo is an elite gadgeteer known for designing and deploying unique precision tools that help agents navigate even the trickiest of missions. With a deep understanding of mechanics, electronics, and engineering, Gizmo is the go to agent whenever a mission demands crafting stealthy and compact secret agent devices!



# KEY GRABBER

**DISCUSSION:** ⌚ 3 min

Simple machines are amazing tools that help us do work with less effort. Think about turning a doorknob. That's a lever in action! A lever is like a long stick that can pivot, or turn, around a point called a pivot. When you push or pull on one end of the lever, you apply force. This force makes the lever move, helping you do tasks like lifting heavy objects or opening doors. Now, let's say you want to reach something far away. That's where extending comes in! By adding more parts to a simple machine, like making a lever longer or adding a stick to grab things, we can extend our reach and make it easier to do tasks. So, remember, whether it's opening doors, lifting heavy objects, or reaching for things far away, simple machines are there to assist in every day tasks!

**ACTIVITY DIRECTIONS:** ⌚ 5 min

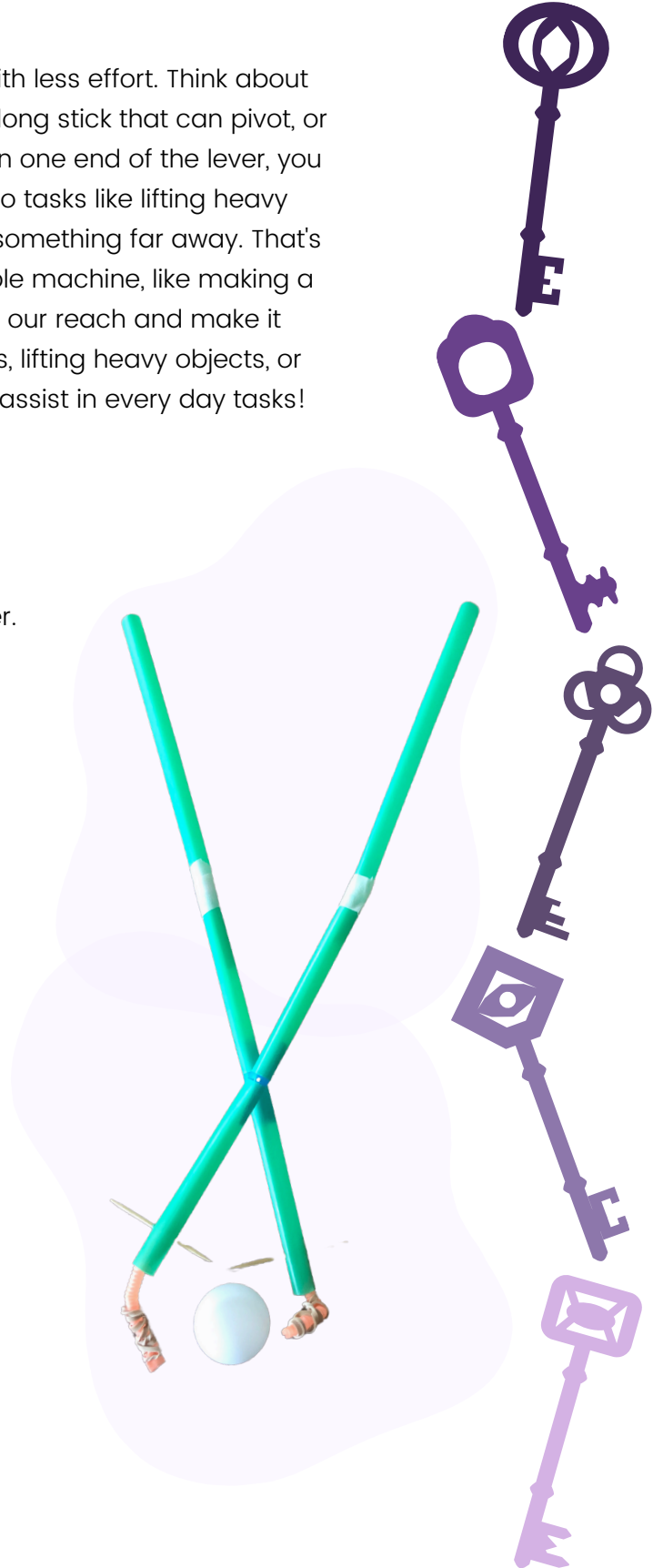
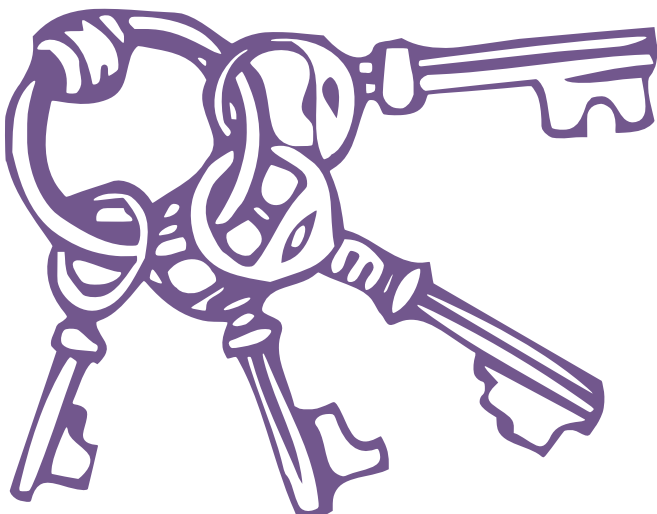
**1.** Each student will be making their extendable key grabber.

Give each student:

- 1 bendy straw
- 6 boba straws
- 5 toothpicks


**2.** Put out the following materials for all students to use:

- Masking tape
- Scissors
- Rubber bands (for the grabber's grip)



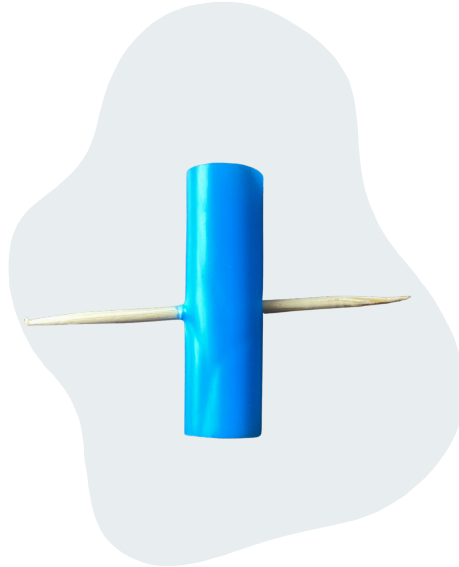
# KEY GRABBER

## ASSEMBLY:

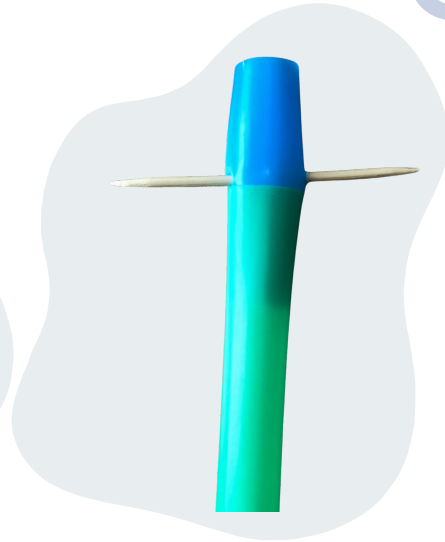
 25-30 min



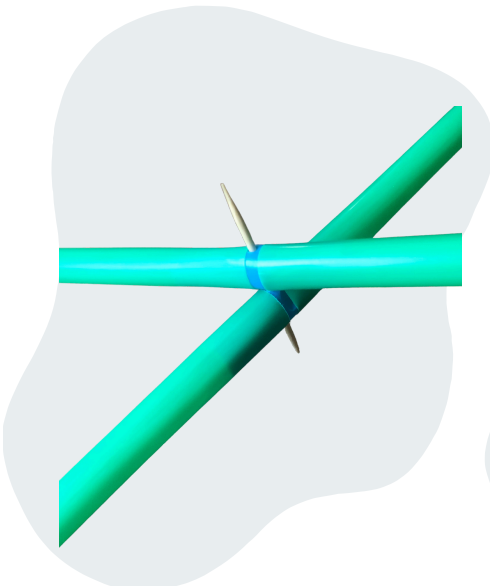
1. Pass out materials. Have students cut one boba straw into fourths. For younger students, you might want to mark where they need to cut.



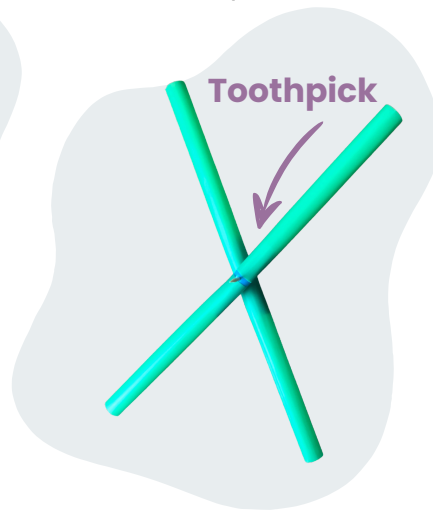
2. Carefully insert the toothpick into the center of one boba straw piece. Slowly push and twist the toothpick in order to break through the plastic. Repeat step two with a second straw piece.



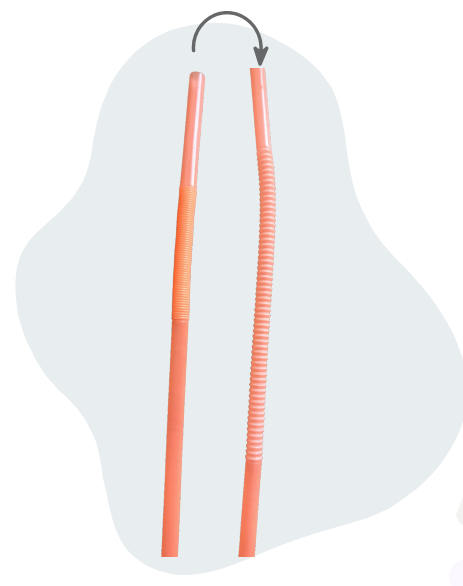
3. Lightly fold one end of the boba straw piece (with toothpick) in order to insert it into a full boba straw. Then, remove the toothpick.



4. Repeat step three with a second straw piece (with toothpick hole) and second full boba straw. Reinsert one toothpick into both straw holes.



5. Test the toothpick lever to ensure the "legs" of the grabber move back and forth as you open and close the boba straw pieces. It should resemble the movement in a pair of scissors!

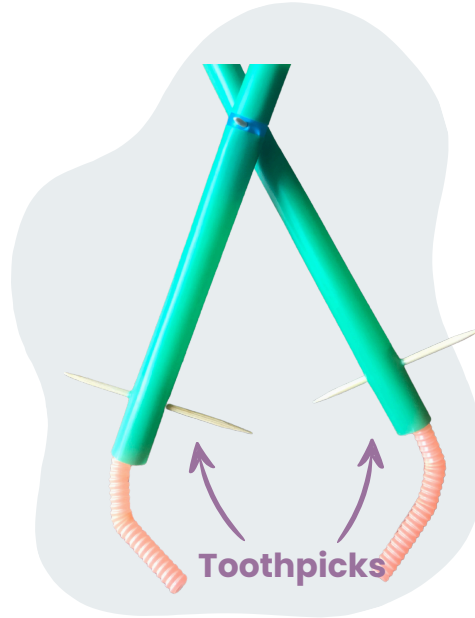
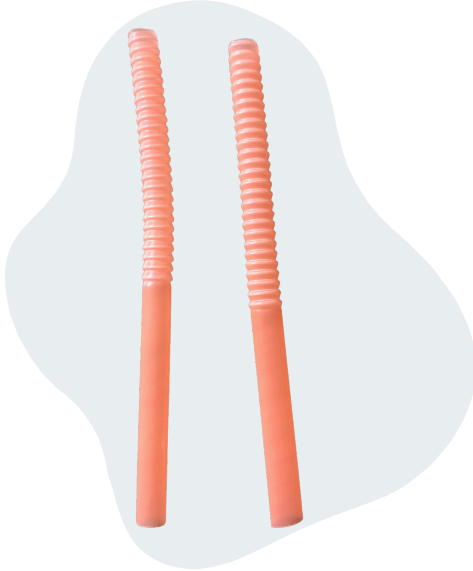


6. Next, take a thin, bendy straw and trim one end to shorten. Do not cut the articulated portion of the straw just yet. Stretch the articulated portion of the straw.



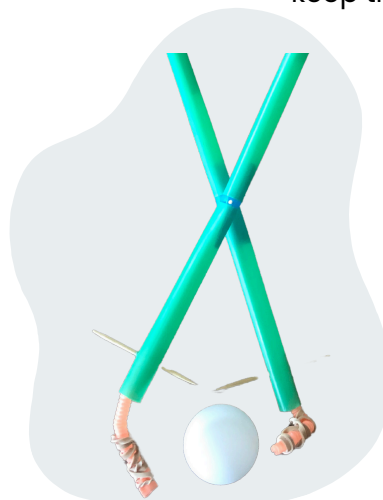
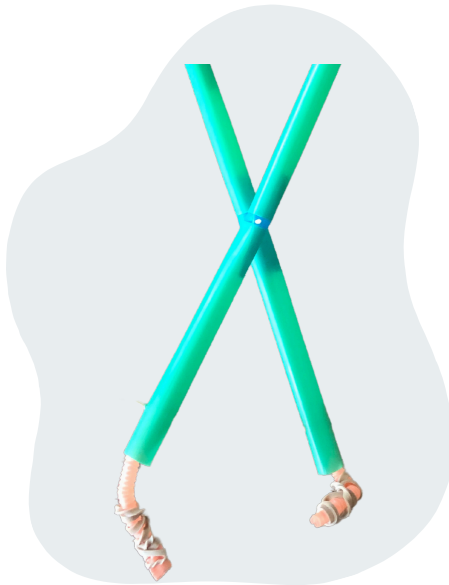
## ASSEMBLY CONTINUED:

### Connecting the Beams



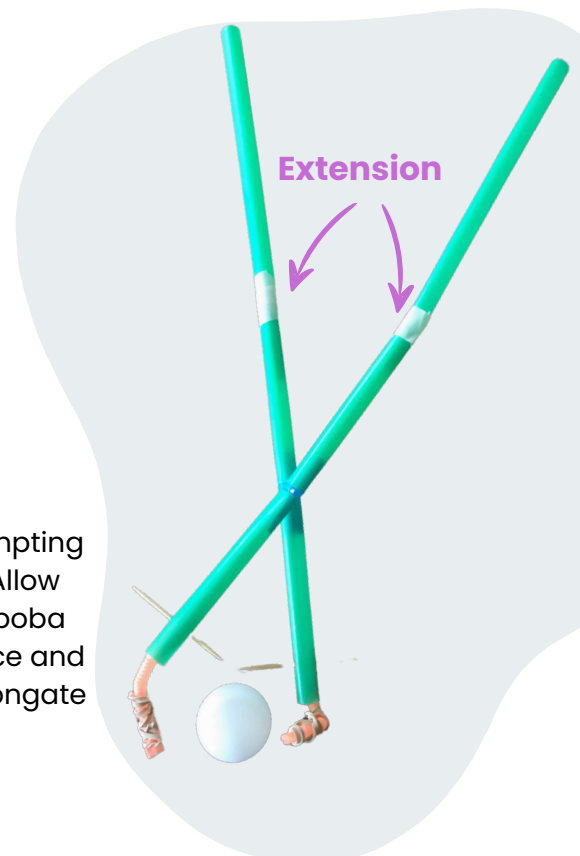
**7.** Cut the bendy or articulated portion into two even pieces.

**8.** Insert the non articulated end of the bendy straw into one end of the boba straw. Similarly to step two, carefully insert a toothpick into both the boba straw and inserted bendy straw in order to keep the bendy straw in place.




**9.** Repeat step 8 on the other boba straw. Adjust the direction of the bendy straw as needed. Then, wrap rubber bands around the bendy straw in order to provide a no slip grip.

**10.** Test your key grabber by attempting to pick up a ping pong ball! Allow students to insert additional boba straw into the top of their device and secure with tape in order to elongate their key grabber!

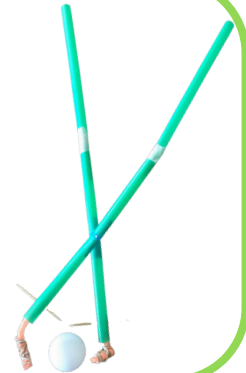


# KEY GRABBER


## TESTING

 5-7 min

Once students have completed their devices, have students test their prototype by attempting to grab the “key” with their grabber. Use ping pong balls to act as the key. Encourage students to observe and analyze the effectiveness of their designs, noting any successes or areas for improvement. Facilitate a discussion with the class to share observations and insights from the testing phase, emphasizing the importance of iteration and refinement in the engineering design process.

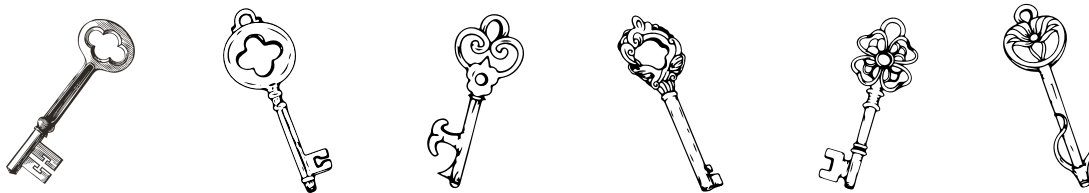


## OBSERVE & EXPLAIN

 3-5 mins

Our grabber works a lot like a seesaw. It has a special point in the middle where it pivots or turns. When you squeeze one end, you’re using force to make the other end move. That’s how a lever works! It helps us reach out and pick things up without having to stretch too far. Discuss with the class:

- What did you notice when building and/or using the device?
- Can you identify the lever within the device?
- What helped the device grip the retrieved item, or, ping pong ball?
- What part of the device allowed the retrieving end to move?



### Exit Ticket



Ask each student one of the following questions as they walk out the door.

- Q: What is a lever?
  - A: A lever is like a long stick that can pivot, or turn, around a point called a pivot. When you push or pull on one end of the lever, you apply force. This force makes the lever move, helping you do tasks like lifting heavy objects or opening doors
- Q: Can you name an example of a lever, grabber, or similar everyday object?
  - A: A doorknob is one example of a lever!