

# Go Guide

Hydraulic  
Claw



Build an example claw, then experiment and evolve your own unique design!



## You Are Here

Choose how you would like to complete this activity.  
Download documents & videos at [shop4-h.org](http://shop4-h.org)

### Go Guide

Start here! Build your Claw, evolve your design, and begin the Ocean Cleanup Challenge!

### Optional Lab

-Fluid Power Lab  
(Ages 12+)

### Optional Challenges

-Claw Ball Challenge\*  
-HORSE Challenge\*

\*See Page 10



## Supplies

### Claw Parts

These are the parts you need to build one claw, plus some extra parts for your own unique designs.

NAME	QTY	PICTURE
<b>Strips</b> 30 cm (12 in) SKU 1821-31	<b>4</b>	
<b>Slide Stop</b> 7 cm (3 in) SKU 1821-49	<b>1</b>	
<b>Screws</b> 25 mm (1 in) SKU 1821-22	<b>8</b>	
<b>Nuts</b> #10 hex SKU 1821-25	<b>4</b>	
<b>Cylinder Screws</b> SKU 1821-21	<b>2</b>	
<b>Blocks</b> SKU 1821-34	<b>4</b>	
<b>Cylinders</b> 4.5 ml SKU 1821-52	<b>2</b>	
<b>Tubing</b> 38 cm (15 in) SKU 1821-51	<b>1</b>	
<b>Zip Ties</b> 1823-50	<b>4</b>	
<b>Dowels</b> various sizes SKU 1821-20	<b>12</b>	 <u>Dowel Sizes</u> 2x 15 cm (6") 4x 7.5 cm (3") 6x 5 cm (2")

### Materials You Supply



#### Recycling Materials

What can you use for your claw grippers?



String



Tape



Screwdriver



A Container

To hold water for filling cylinders

#### Optional Tools



Modify materials to make even more creative designs with the **Maker Tool Set**

SKU 1823-84

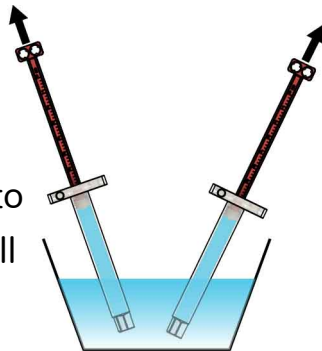


### Fill The Hydraulics

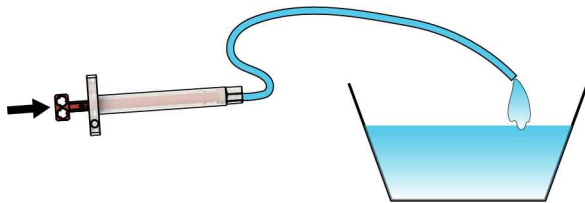
- 1 Fill both **cylinders** with **water**.

Place tips  
under water.

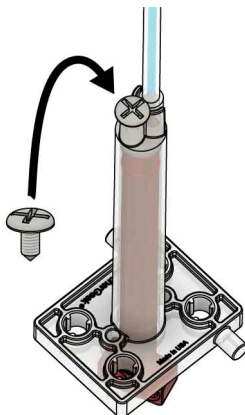
Pull pistons to  
completely fill  
with water.



- 3 Fill the **tubing** completely with water by **pushing the piston** all the way in.



- 5 Insert a cylinder **screw** into each cylinder to secure the tubing.

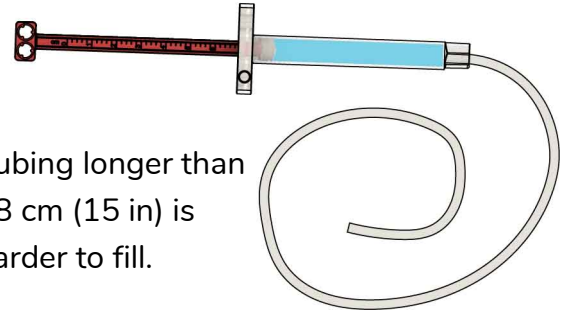


### Optional Tip

Food coloring  
makes water  
easier to see.

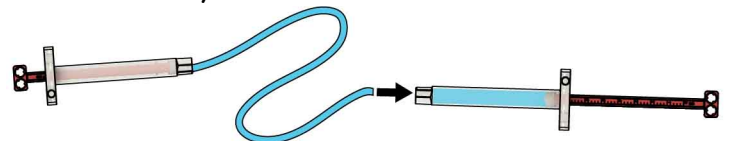


- 2 Attach 38 cm (15 in) of tubing to just **one** filled **cylinder**.



Tubing longer than  
38 cm (15 in) is  
harder to fill.

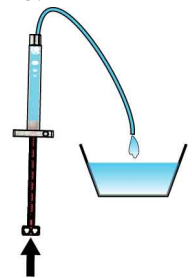
- 4 Attach the **tubing** to the other cylinder.



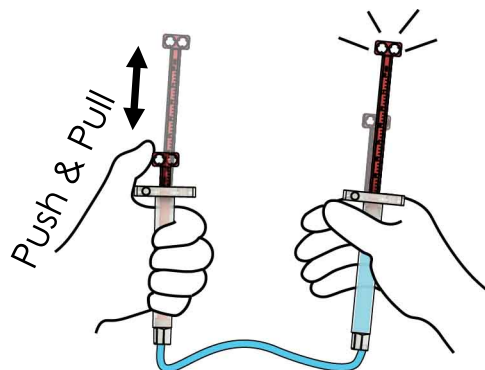
Remove all bubbles from cylinders & tubing for best performance.

Tip the cylinder so bubbles rise to the base of the tube.

Push the air out and refill.



- ☒ Your **hydraulics** are **done!**  
Test them out.



Want to learn more  
about hydraulics?

Download the  
**Fluid Power Lab** at  
[shop4-h.org](http://shop4-h.org)  
Ages 12+



## Which Claw Will You Make?

These examples get you started, then you can experiment and evolve your own unique design!

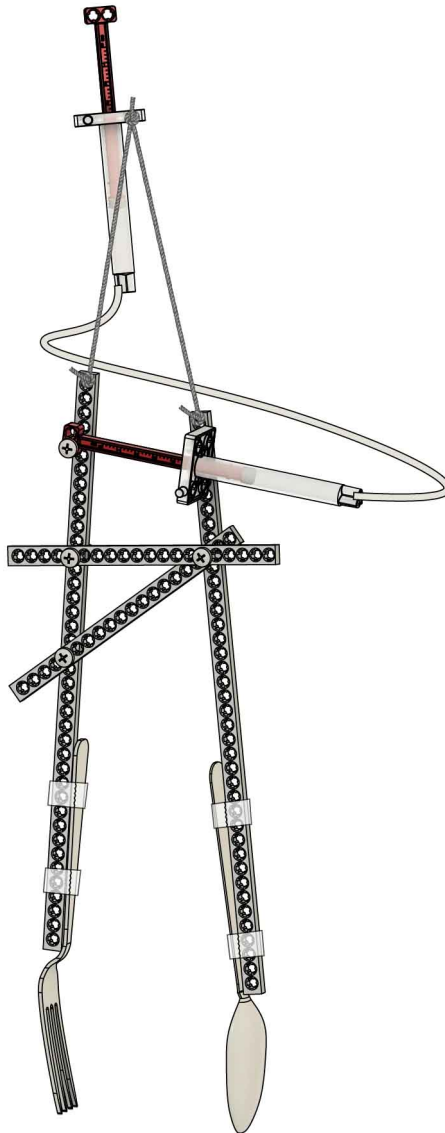
### Accordion

(Page 4)



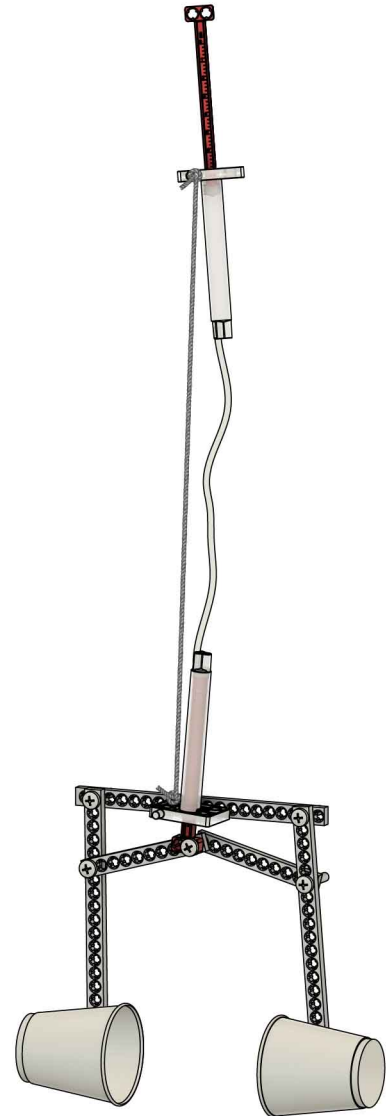
### Chopsticks

(Page 6)



### Pincer

(Page 8)



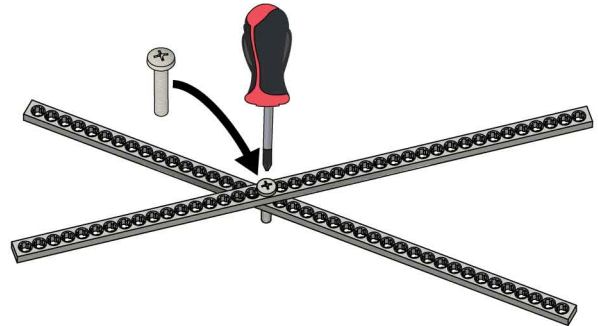
After you make your claw, try a Challenge! (Page 9-10)



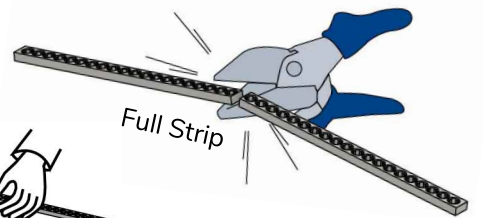


## Accordion Example

- 1 Cross two strips and add a screw near the middle.



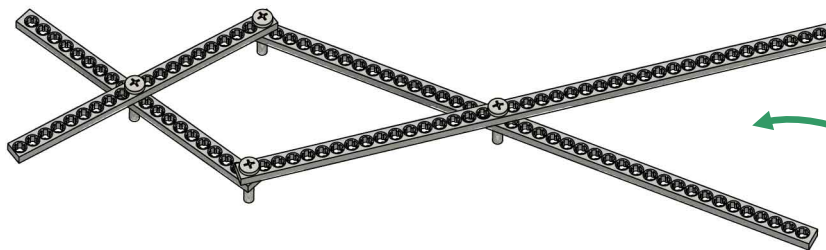
- 2 Make two half strips, if you don't already have them, by cutting or snapping a full strip.



2x

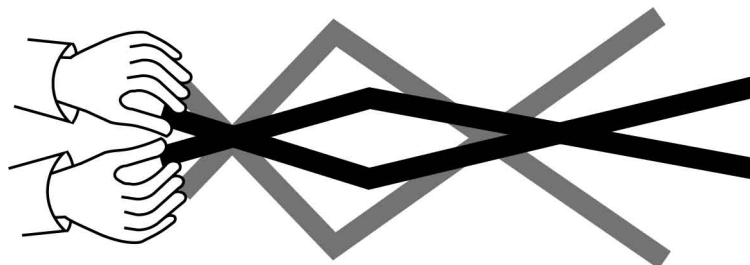


- 3 Add the half-strips and screws to make an accordion-style mechanism.



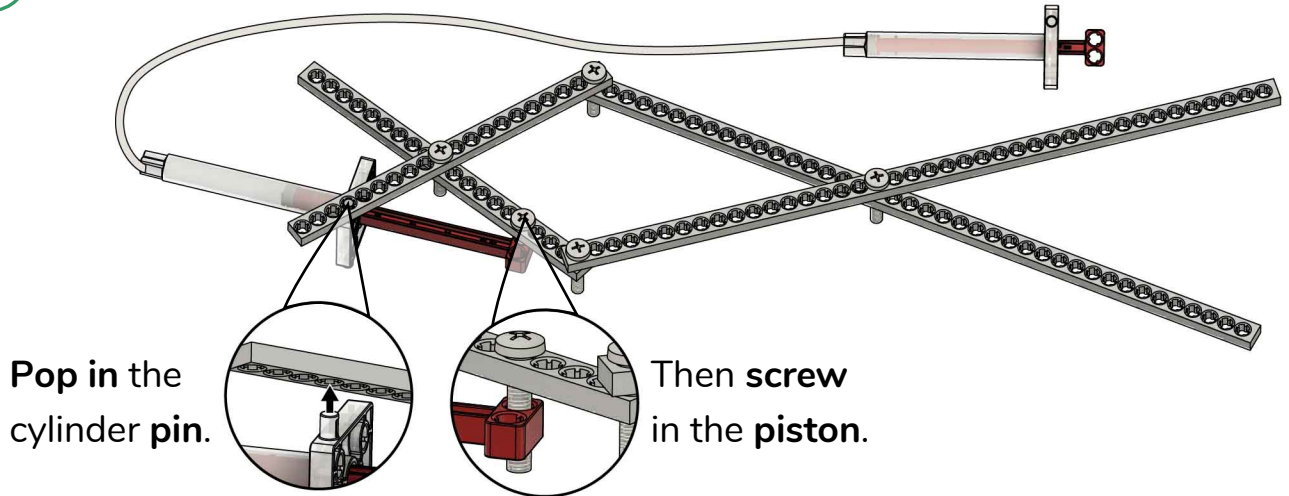
This mechanism moves like an accordion.

- 4 Test your mechanism!  
Next, you are going to add hydraulics.





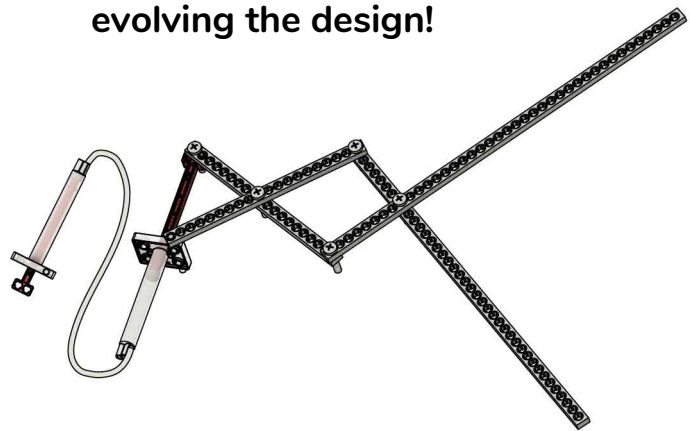
- 5** Add your **cylinder** assembly to the mechanism.



- 6** **Test your claw!** If it's tipping over, use string to hold it up.



- 7** Your example is done, but you aren't... **Tinker with it and keep evolving the design!**



**Add end effectors to grip or scoop objects.**

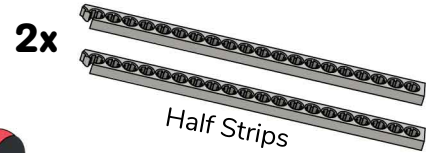
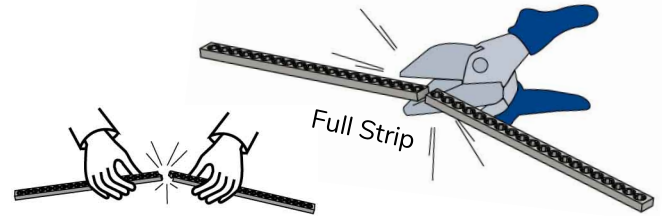


Test a lot of them – they all have different strengths and weaknesses.

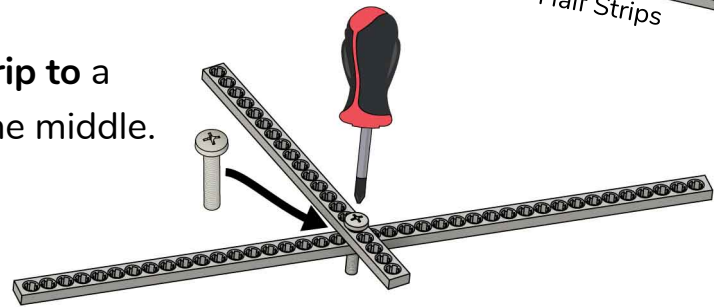


## Chopsticks Example

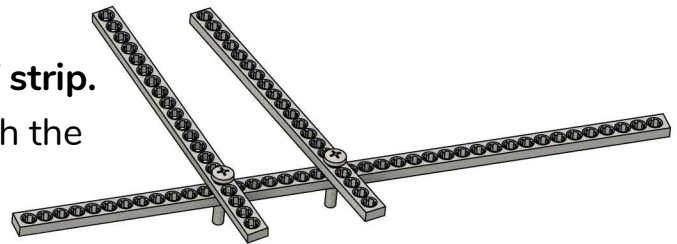
- 1 Make two half strips, if you don't already have them, by cutting or snapping a full strip.



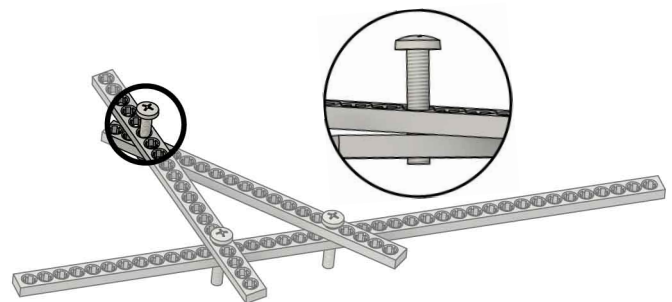
- 2 Screw a half strip to a full strip near the middle.



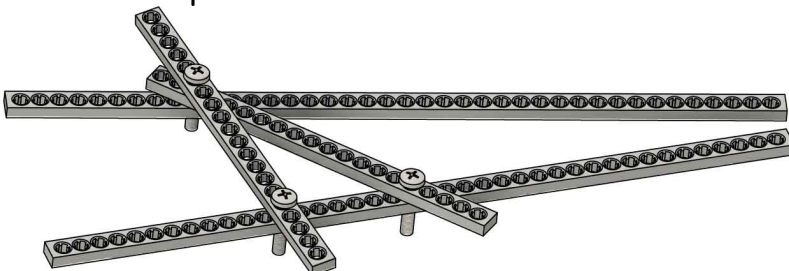
- 3 Screw on another half strip. It doesn't have to match the picture exactly.



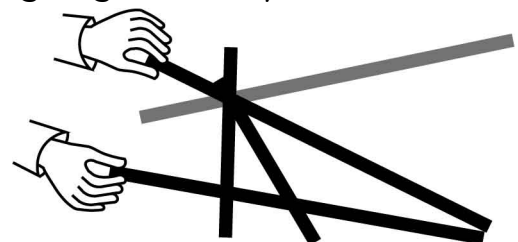
- 4 Screw the ends of the half strips together, so the screw barely sticks out the bottom.



- 5 Put a full strip under the screw from Step 4 and screw it in.



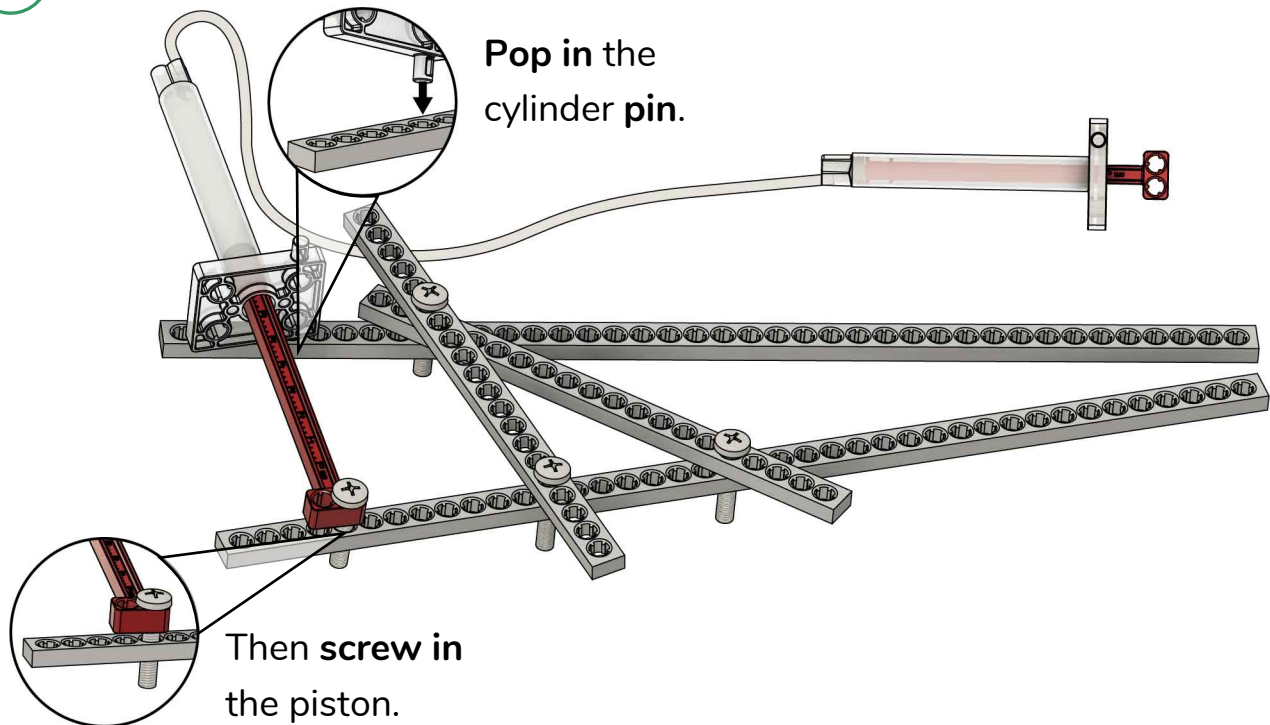
- 6 Test your claw! Next, you are going to add hydraulics.



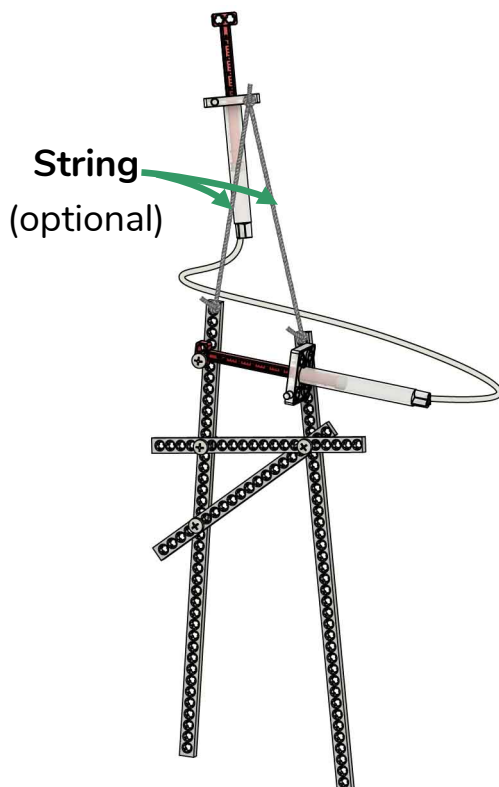




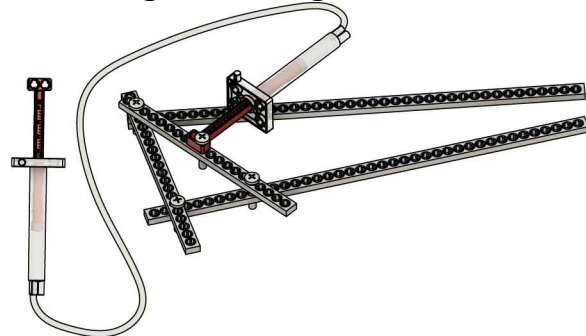
- 7** Add your **cylinder** assembly to the mechanism.



- 8** Test your claw! If it's tipping over, use string to hold it up.



- 9** Your example is done, but you aren't... **Tinker with it and keep evolving the design!**



Add end effectors to grip or scoop objects.



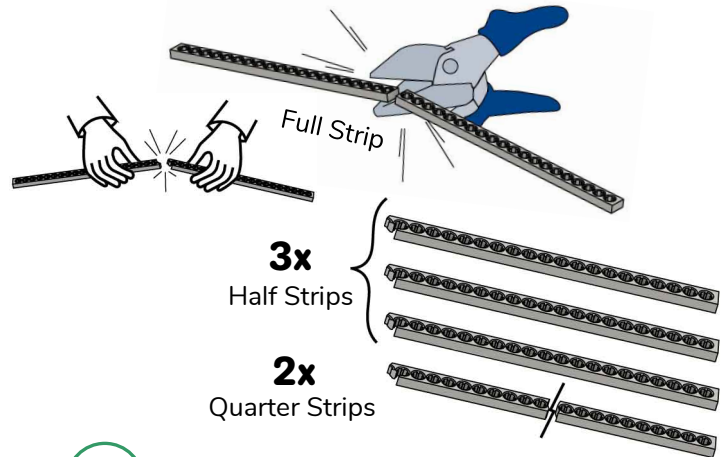
Test a lot of them – they all have different strengths and weaknesses.



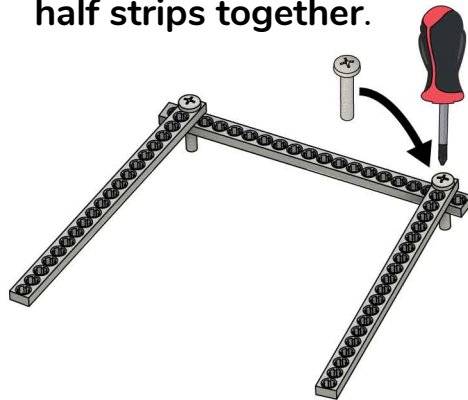


## Pincer Example

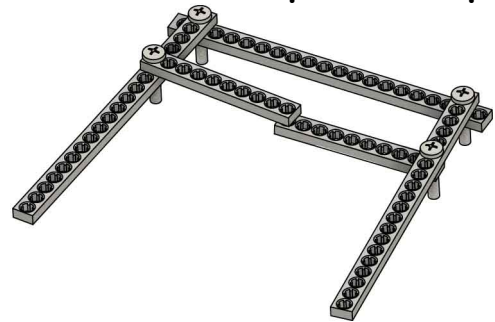
- 1 Make three half strips and two quarter strips if you don't already have them. (This will require 2 full strips.)



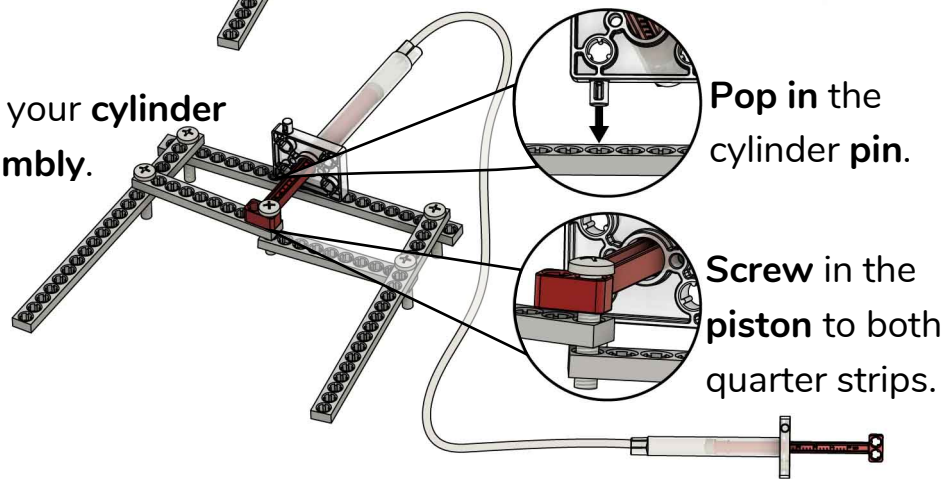
- 2 Screw the three half strips together.



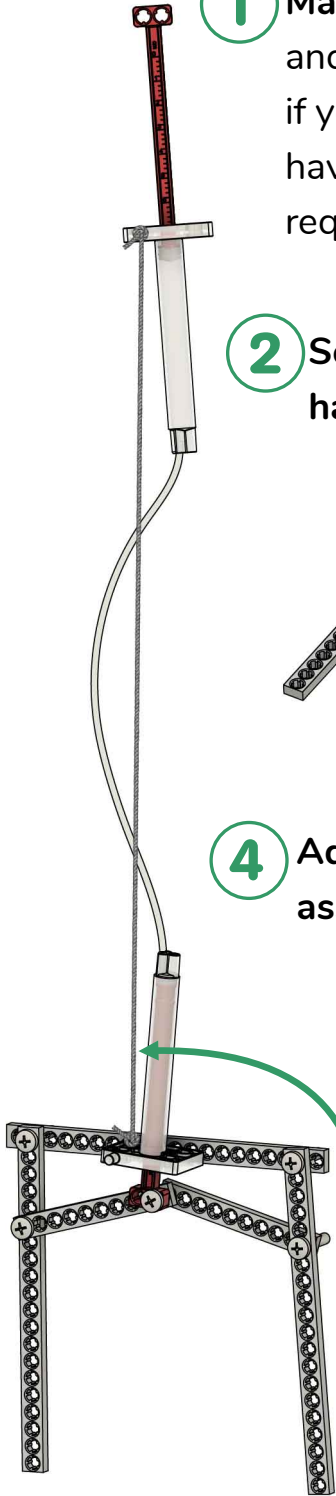
- 3 Use two more screws to attach the two quarter strips.



- 4 Add your cylinder assembly.

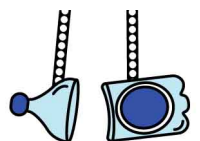
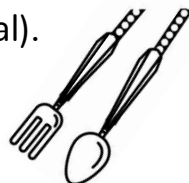


- 5 Test your claw! If it's tipping over, hold it up with string (optional).



- 6 Your example is done, but you aren't... Tinker with it; keep evolving the design!

Add end effectors to grip or scoop objects.





## Ocean Cleanup Challenge

### Design your claw to clean up the ocean!

Plastic trash is harming ocean wildlife and washing up on beaches around the world. Use your claw to complete all three stations of the challenge (you can change your design between stations).



Learn more about seaborne trash at [fws.gov/refuges/features/OceansOfTrash.html](https://fws.gov/refuges/features/OceansOfTrash.html)

### Constraints:

(rules and limits for your design)

- You must use a claw **powered by hydraulic cylinders**.
- You may **only use claw supplies** listed on Page 1
- You have \_\_\_\_\_ **minutes to complete each station** of the challenge
- You have \_\_\_\_\_ **minutes to change designs** between each station

One claw can't do it all (at least not well), so change your claw design for each part!  
The engineering design process is never done – there is no perfect design.

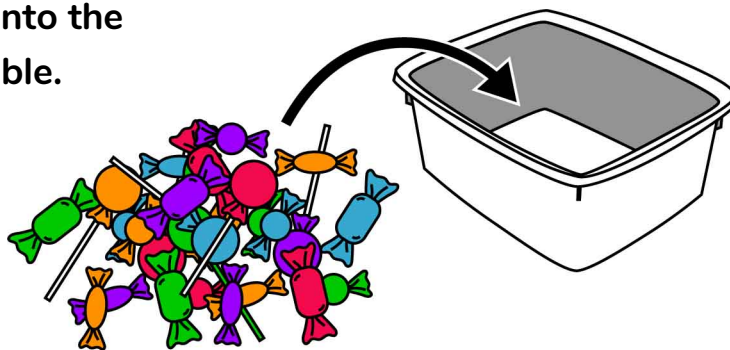
### Station 1: Garbage Patch

Huge amounts of trash are floating in the ocean. **Load trash into the container as fast as possible.**

#### Criteria:

**+5 points** for every piece of “trash”

**+1 point** for every extra second left on the clock



You can use anything almost for “trash.”  
Candy, office supplies, toys, recyclables, etc.



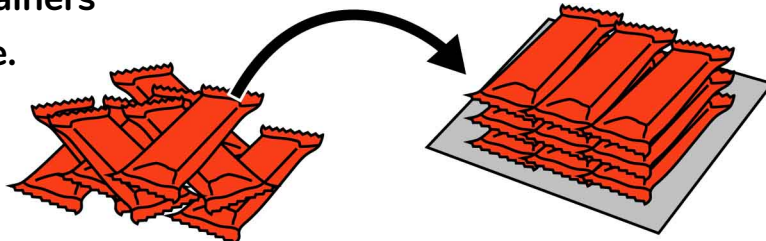
## Station 2: Load the Barge

Containers of trash must be shipped to land for processing. **Stack containers on the barge as fast as possible.**

### Criteria:

**+5 points** for each “container” on the “barge”

**+1 point** for every extra second left on the clock



Anything that can be stacked can be a “container.” Snack bars, candy, blocks, etc.

Use paper or an index card for the “barge.”

## Station 3: Beach Cleanup

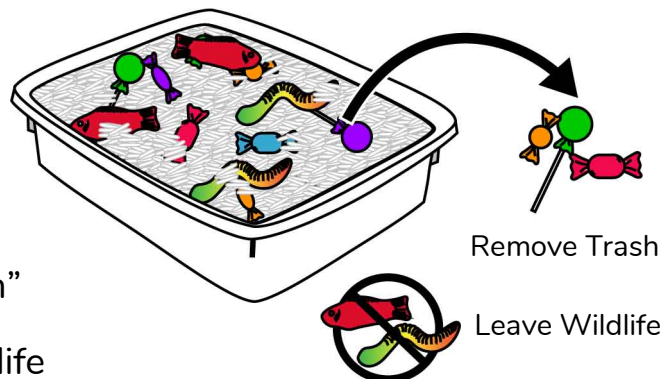
Pieces of trash are washing up onto beaches. Design a claw to separate the trash from the sand without disturbing any of the wildlife.

### Criteria:

**+5 points** for every piece of “trash”

**–10 points** for every piece of wildlife

**+1 point** for every extra second left on the clock



Remove Trash



Leave Wildlife

Rice or sugar can be used as sand. Candy, fishing lures, etc. can be used for trash/wildlife.

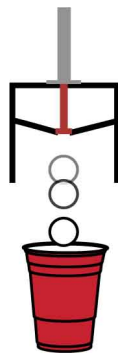
## Additional Challenges

### Claw Ball Challenge

Put a cup (goal) on each side of the room. Each team can pick up the ball but must pass or drop the ball after walking three steps. The first team to get 5 goals wins!



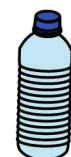
GOAL 1



GOAL 2

### HORSE Challenge

Take turns picking up different objects. If one player can pick it up, and the other players can't, that player gets a letter towards the word “HORSE.” The first player to spell “HORSE” wins!

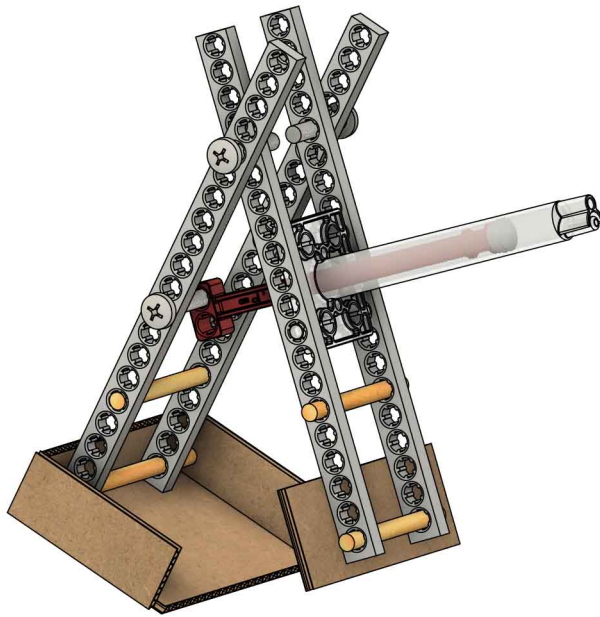




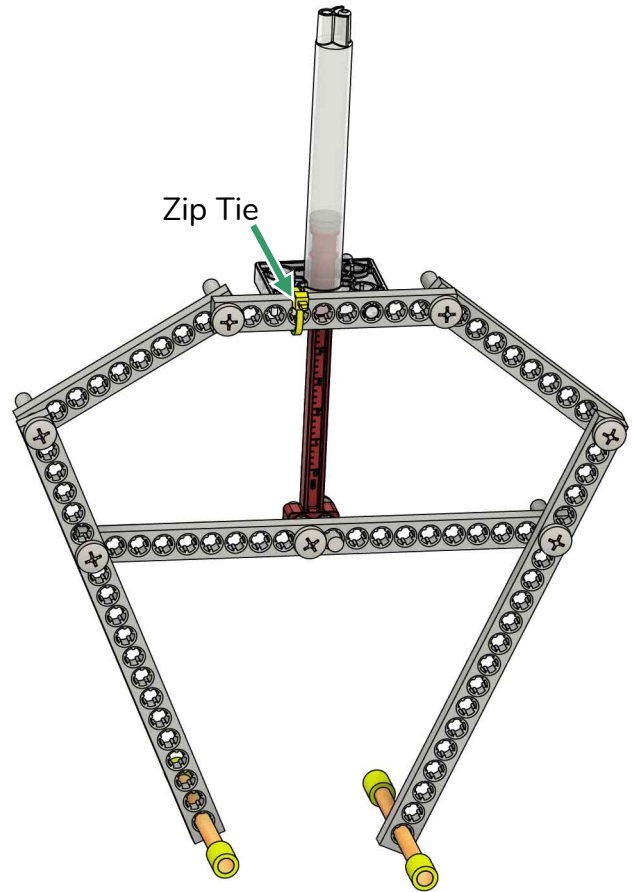


## Inspiration

Try making completely different designs!



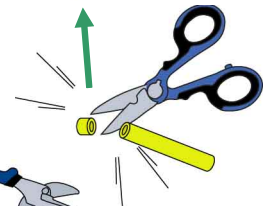
Tap or wiggle dowels into holes with teeth to secure them.



Zip Tie

Cut slide stop with scissors.

Cutters  
Optional



Tools unlock even more design possibilities!

