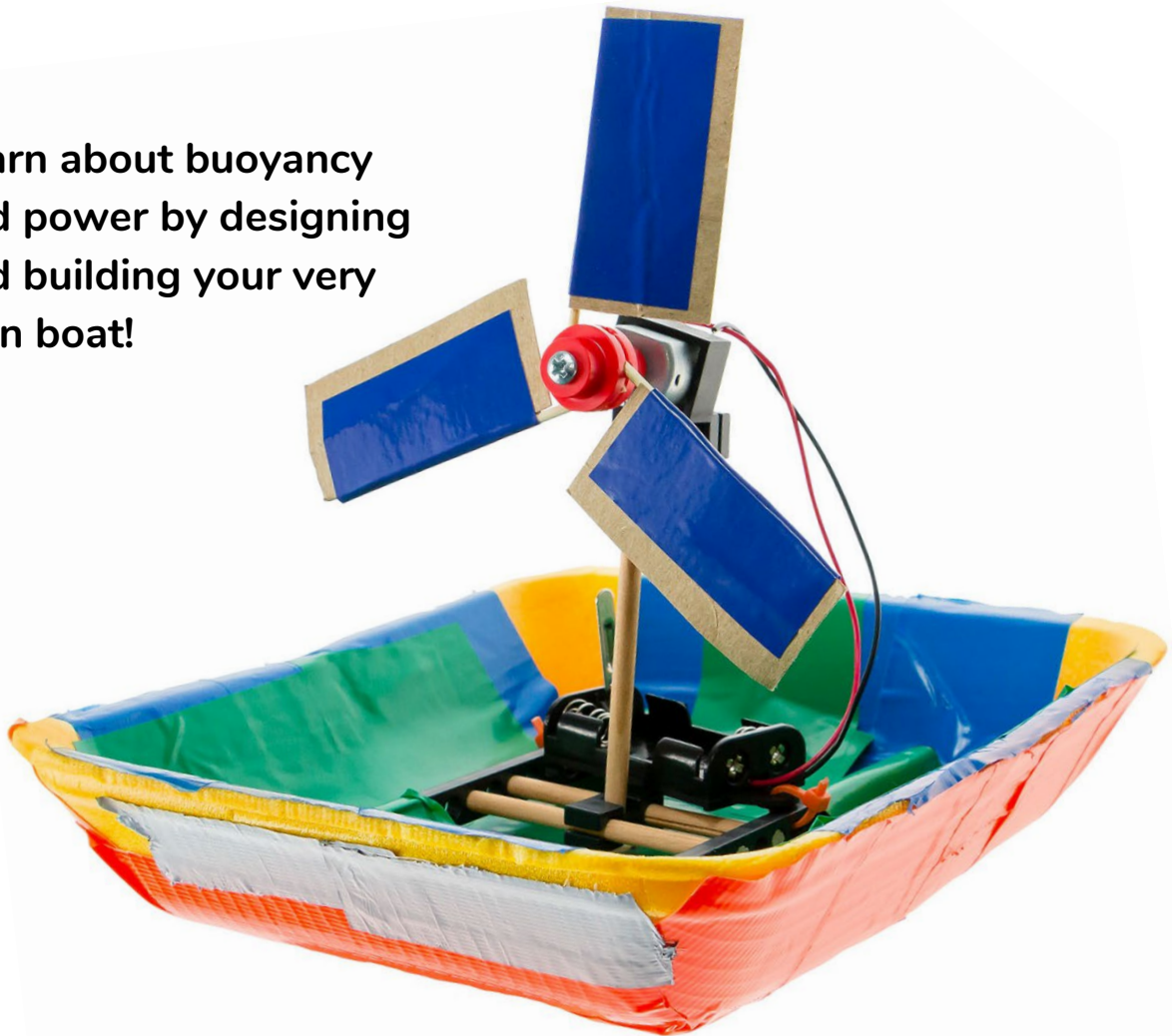


Go Guide

Build-a-Boat

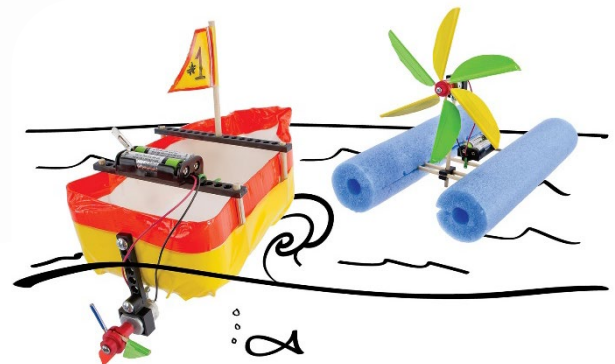


Learn about buoyancy and power by designing and building your very own boat!



Electricity and water!?!

You won't get shocked – go ahead – play with it in the pool/tub! The low voltage of this activity is safe to use in the water. Avoid submerging the motor or batteries for long periods, though, as you may damage them.



You Are Here

Choose how you would like to complete this activity.
Download documents & videos at shop4-h.org

Go Guide

Start here! Build your Boat, evolve your design, and begin the Speed Boat Challenge!

Optional Labs

-Propeller Design Lab

Optional Challenges

- Delivery Challenge*
- Heavy Load Challenge*
- Target Challenge*










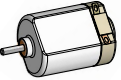



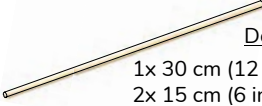
*See Page 7



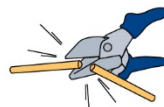
Supplies

BOAT PARTS

These are the parts you need to build one Boat.

NAME	QTY	PICTURE
Blocks SKU 1821-34	2	
Strips 30 cm (12 in) SKU 1821-31	3	
Screws 25 mm (1 in) SKU 1821-22	4	
Nuts #10 Hex SKU 1821-25	4	
Project Sticks 10 cm (4 in) SKU 1821-66	10	
Mini Hub Cover SKU 1821-66	1	
Mini Hub Base SKU 1821-66	1	
Mini Hub Screw SKU 1821-66	1	
Zip Ties SKU 1823-50	4	
Motor 1.5V – 3V SKU 1821-75	1	
Motor Mount Small 1.5V – 3V SKU 1821-69	1	
Battery Holder w/leads & switch SKU 1821-63	1	
Chipboard 22 cm x 5 cm (8.5 in x 2 in) SKU 1823-48	1	
Dowels various sizes SKU 1821-20	8	 <div> <u>Dowel Sizes</u> 1x 30 cm (12 in) 3x 10 cm (4 in) 2x 15 cm (6 in) 2x 7.5 cm (3 in) </div>

Have a Maker Cart?
Use Multi-Cutters to
cut your own dowels.



MATERIALS YOU SUPPLY

- 2x AA Batteries
- Phillips Screwdriver
- Tape
- Scissors
- Safety Goggles
- Recycling Materials
or floating materials for
your boat's hull



Optional Tools

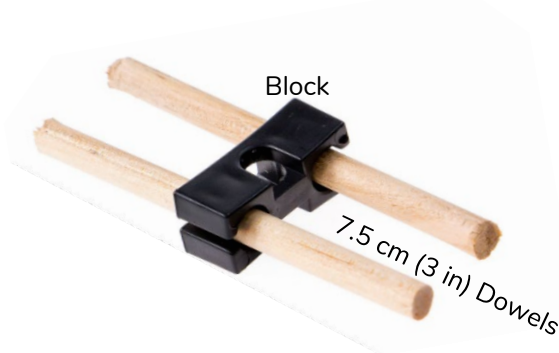


Modify materials to make
even more creative designs
with the **Maker Tool Set**
SKU TGMTS

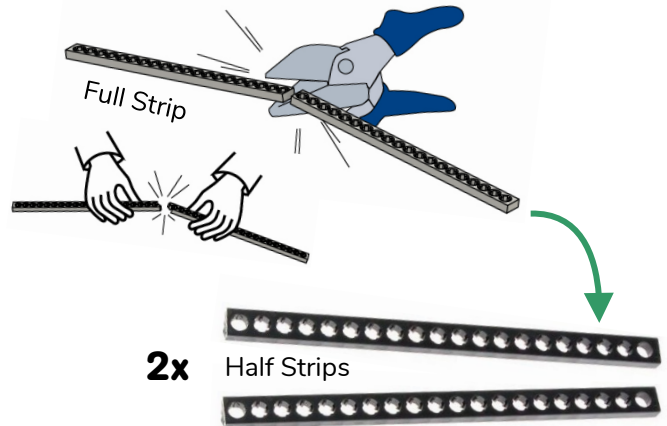


Build the Frame

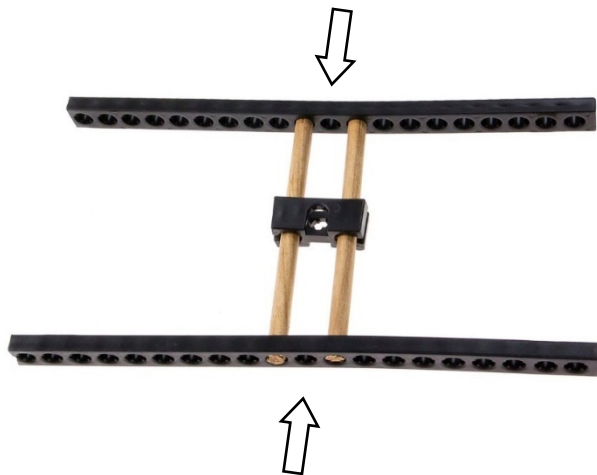
- 1 Wiggle or tap the **two 7.5 cm (3 in) dowels** half way through a **block**.



- 2 Make a **half strip** by cutting or snapping a full strip in half.



- 3 Wiggle or tap the **half strips** onto the **dowels**, from Step 1, so the dowels are near the center.



- 4 Wiggle or tap the **10 cm (4 in) dowel** through the center hole of the **block**.



- ✓ Your frame is finished!
Time to add the motor.

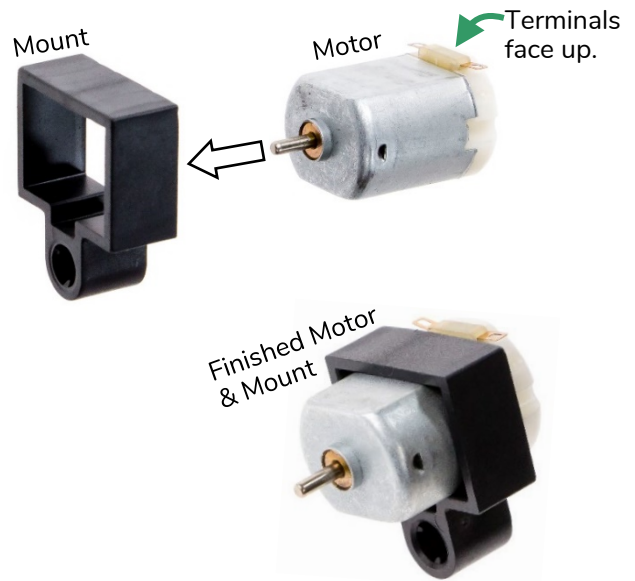


Mount the Motor

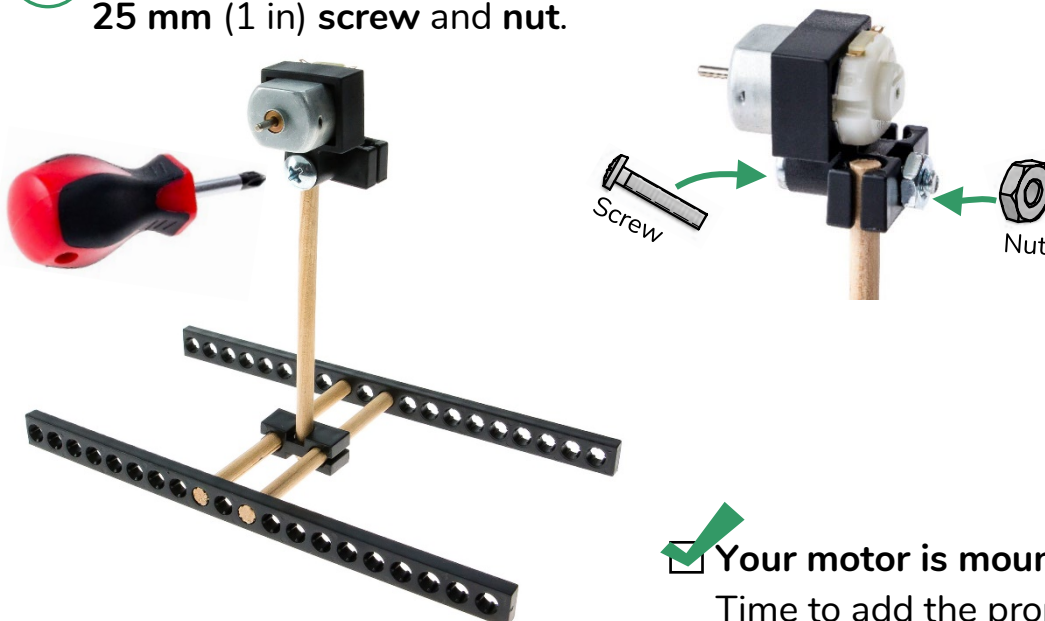
- 5 Wiggle or push a **block** onto the **dowel**.



- 6 Push the **motor** into the **mount**.



- 7 Attach the **motor mount** with a 25 mm (1 in) **screw** and **nut**.

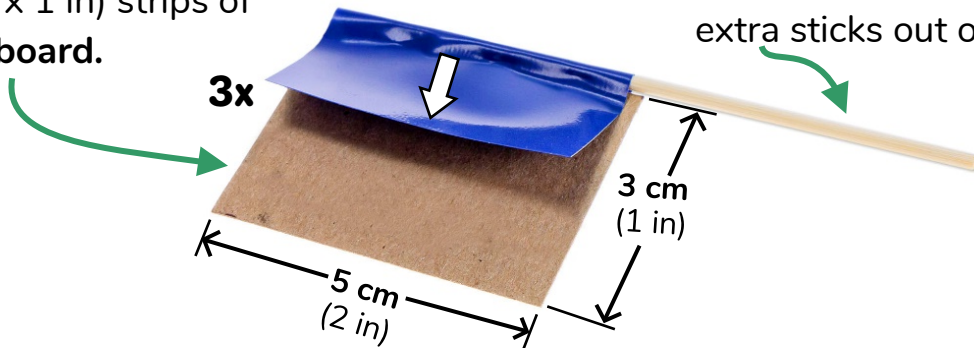


- ☒ **Your motor is mounted!**
Time to add the prop blades!



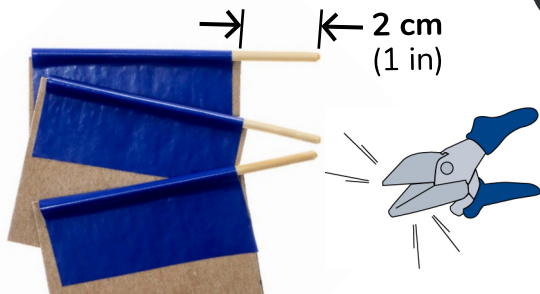
Make the Propeller

- 8** Cut three 3 cm x 6 cm (2 in x 1 in) strips of chipboard.

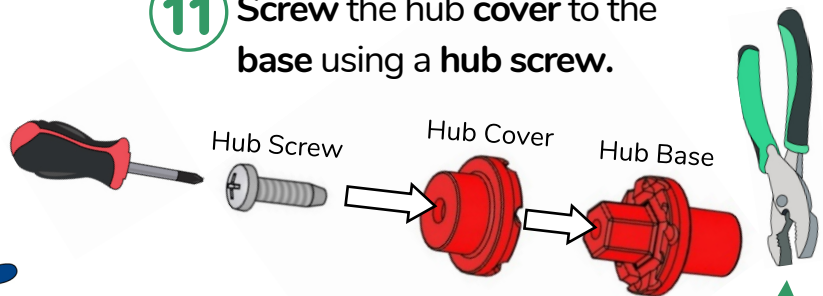


- 9** Tape each piece to a **project stick** so the extra sticks out one side.

- Optional**
10 Cut the **extra** down so only 2 cm (1 in) sticks out from the blade.



- 11** Screw the **hub cover** to the **base** using a **hub screw**.

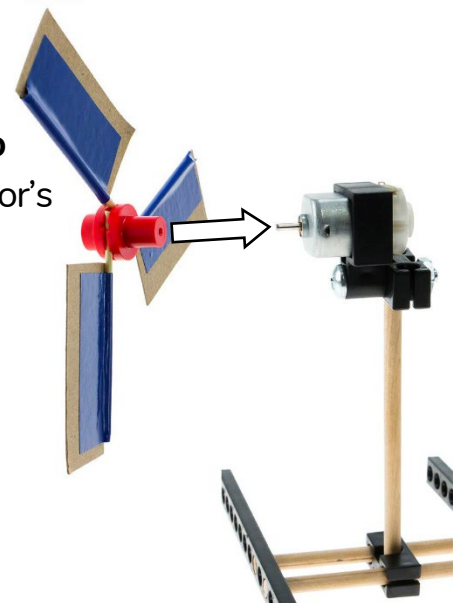


Optional: Hold the base with pliers while driving the screw.

- 12** Loosen the screw just enough to **slide** in your **blades**, then **retighten** the screw.



- 13** Push the **hub** onto the motor's **shaft**.

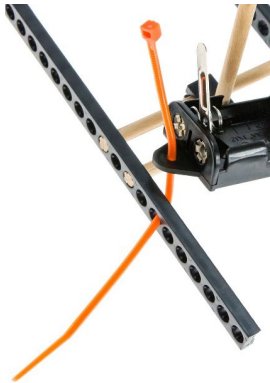


Go Guide Build-a-Boat



Power-Up!

- 14** Put the **zip tie** through the **battery holder** and one of the holes on the **frame**.



Safety First!

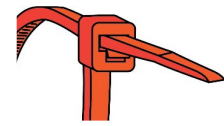
Wear eye protection during these steps and when operating your Boat.



- 15** **Tighten and trim** zip ties.

Make sure you put the zip ties on the right way!

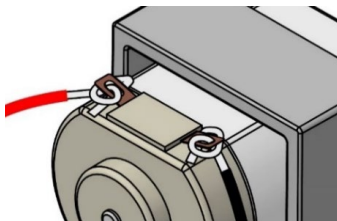
Right!



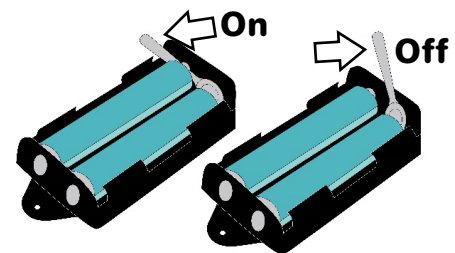
Wrong



- 16** **Wrap** the battery holder **wires** around the **motor terminals**.



- 17** Insert two **AA batteries** in the battery holder. Use the metal lever to turn your propeller on and off.



Caution: No Short Circuiting

Do not let the wires cross or touch the silver metal part of the motor.

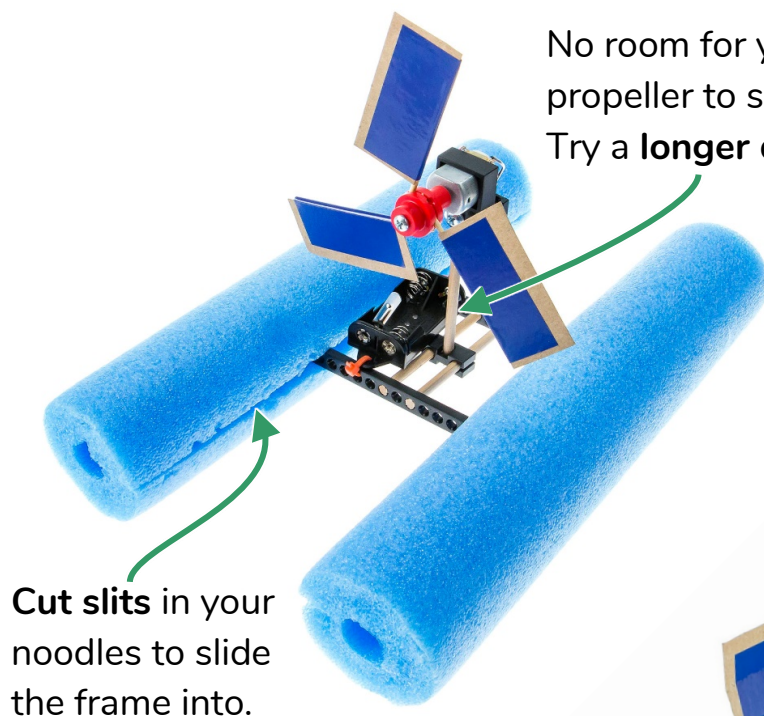


- Test it out!** What happens? Does it blow air at you? If not, see Page 9 to adjust your blades.



Make Your Hull

- 18** Add floating materials to your design to make your hull.
Try foam trays, pool noodles, plastic bottles, food containers, etc.



Cut slits in your noodles to slide the frame into.

No room for your propeller to spin?
Try a **longer dowel**.



Use **duct tape** to attach your propeller or waterproof your hull.

Check out **Pages 8 & 9** for even **more ideas!**

✓ Congratulations

Your example Boat is finished, but you're not...
test it and tinker with it to **make it better!**



Want to learn more about Propellers using your Boat?

Download the [Propeller Design Lab](#) at shop4-h.org
Ages 8+

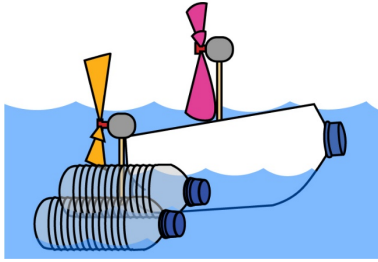
Go Guide Build-a-Boat



Speed Boat Challenge

The fastest boat wins!

Race head-to-head in a regatta. **OR** Compete for the shortest time.



Constraints:

(rules and limits for your design)



Your boat must only be propelled by its 1.5V-3V motor (or the wind/current) during the race.

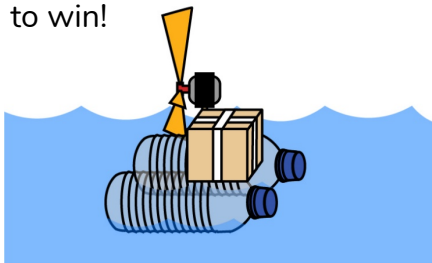


Your boat must be both above the water and right-side-up when crossing the finish line.

Additional Challenges

Delivery Challenge

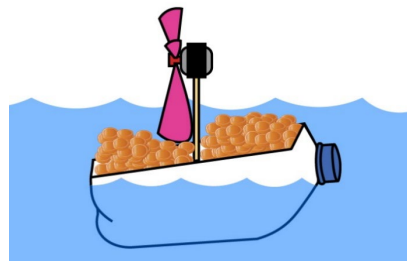
Carry the package across the finish line in the shortest time to win!



Use any waterproof 250 – 500 g (½ – 1 lb) item for the package.

Heavy Load Challenge

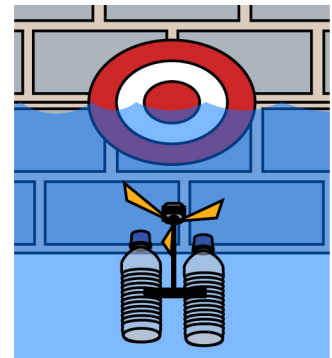
Carry the most cargo across the finish line to win!



Use golf balls, bean bags, pennies (or anything consistent) for cargo.

Target Challenge

The closest boat to the target wins!



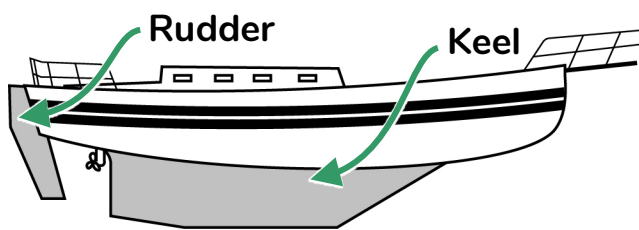


Improve the Hull

Make it Track

(go straight)

Add a **rudder** or **keel** to your boat to help your boat track (go straight).

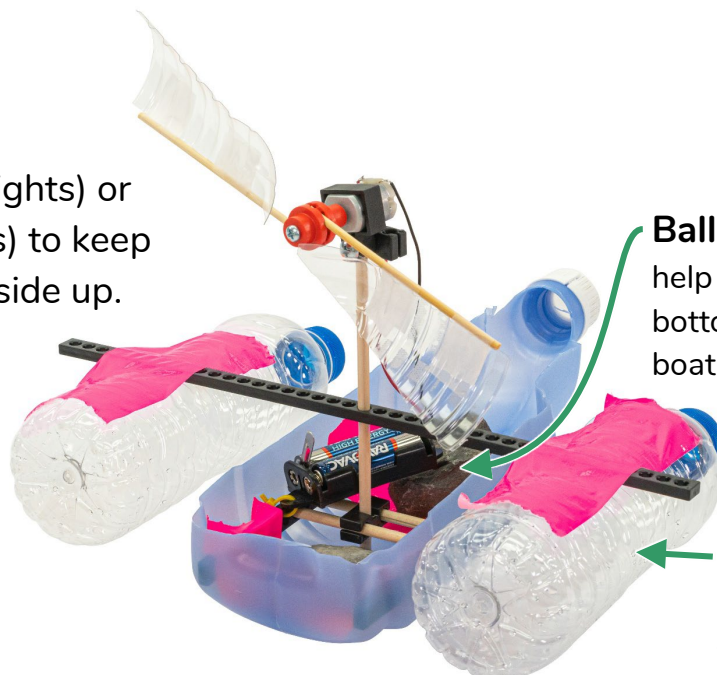


This sail boat has a **fin keel**. Shorter keels (like this one) are faster than long ones, but don't track as well.

Make it Stable

(stay upright)

Use **ballast** (weights) or **pontoons** (floats) to keep your boat right-side up.



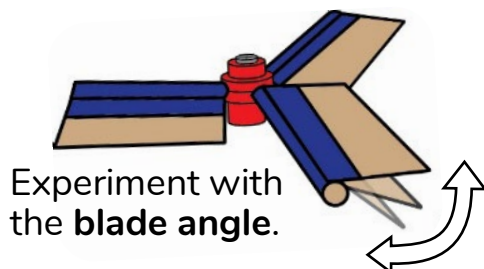
Ballast (rocks) help pull the bottom of the boat down.

Pontoons (bottles) help push the top of the boat up.



Improve the Prop

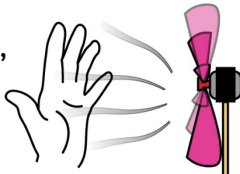
Adjust your Propeller



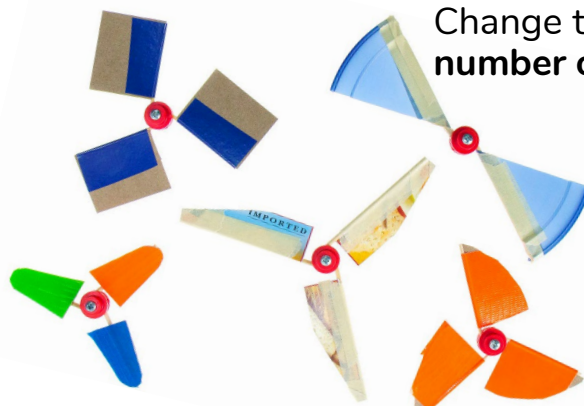
Experiment with the **blade angle**.

Testing Tip

The more wind your prop makes, the harder it will push your boat.



Test **different materials** – what's in your recycling bin!



Try **different sized blades**.

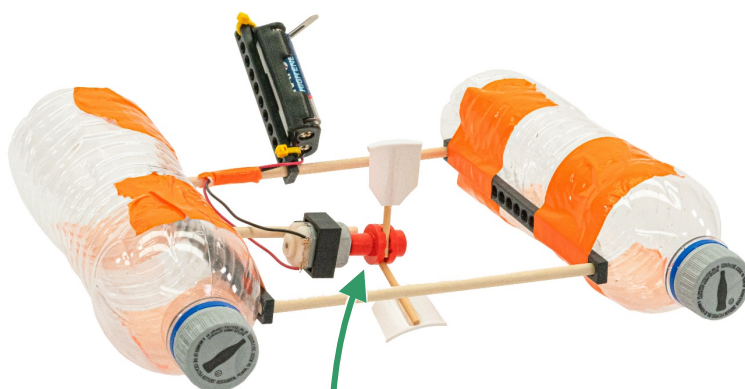
Change the **number of blades**.

Test blades with **different shapes**.

Try Underwater Propellers



Underwater blades must be smaller because water is harder to push than air.



This **water wheel** is only underwater for half its rotation.

