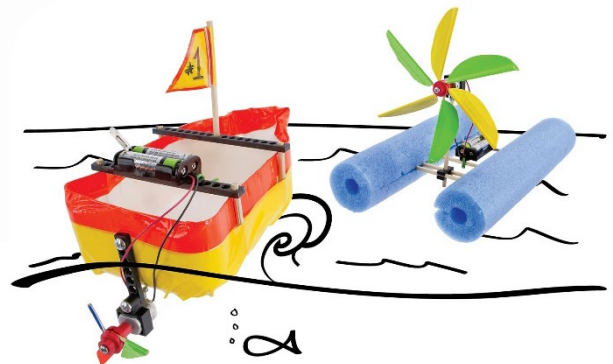# Go Guide Build-a-Boat

TeacherGeek

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.

Check out our **Build-A-Boat Videos** by scanning the QR Code or going to **teachergeek.com/boat**

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	Dowel Sizes 1x 30 cm (12 in) 3x 10 cm (4 in) 2x 15 cm (6 in) 2x 7.5 cm (3 in)

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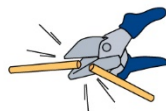
MATERIALS YOU SUPPLY

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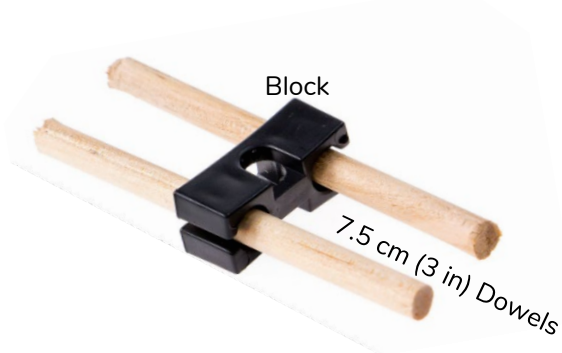- **Recycling Materials** or floating materials for your boat's hull
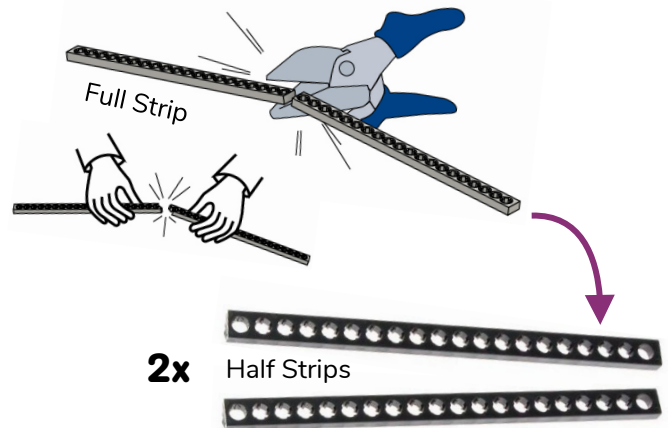

Optional Tools

Modify materials to make even more creative designs with the **Maker Tool Set** SKU 1823-84

TeacherGeek

Build the Frame

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

Block

7.5 cm (3 in) Dowels

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

Full Strip

2x Half Strips

3 **Wiggle** or tap the **half strips** onto the **dowels**, from Step 1, so the dowels are near the center.
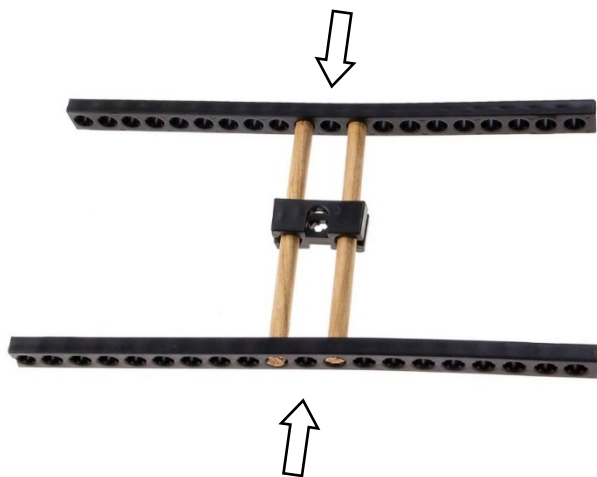
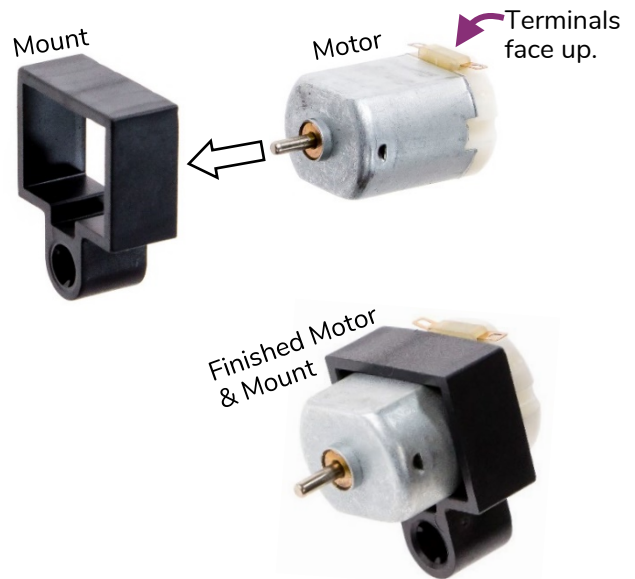**4** **Wiggle** or tap the **10 cm** (4 in) **dowel** through the center hole of the **block**.

10 cm (4 in) Dowel

☑ Your frame is finished! Time to add the motor.

Mount the Motor

5 **Wiggle** or push a **block** onto the **dowel**.
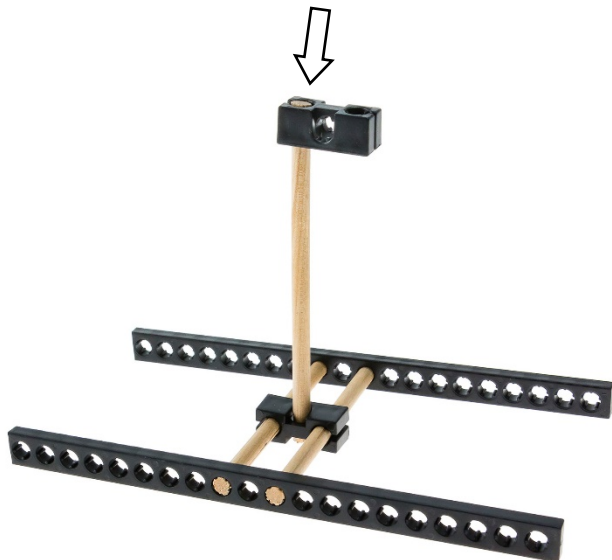
6 **Push** the **motor** into the **mount**.

Mount

Motor

Terminals face up.

Finished Motor & Mount

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

Screw

Nut
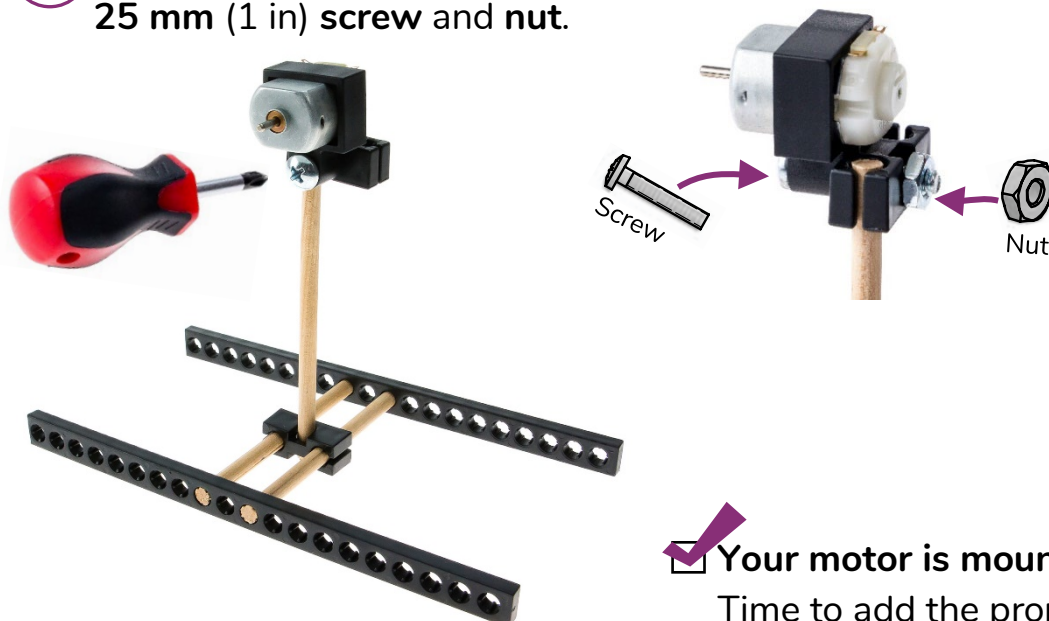
☑ **Your motor is mounted!**
Time to add the prop blades!

Make the Propeller

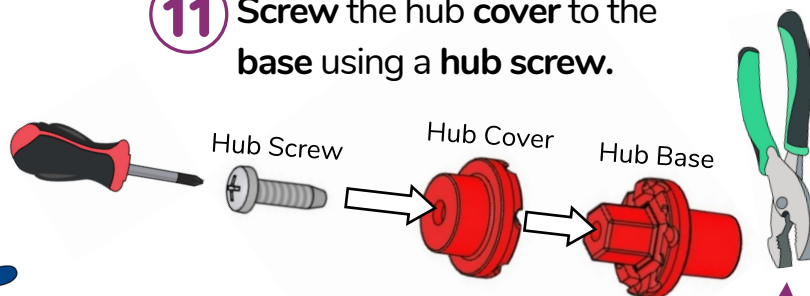**8** **Cut three** 3 cm x 6 cm (2 in x 1 in) strips of **chipboard.**

3x

3 cm (1 in)

5 cm (2 in)
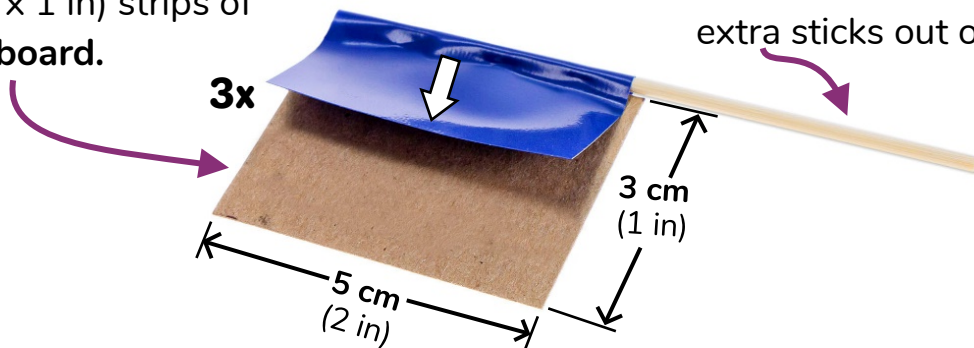
9 **Tape** each piece to a **project stick** so the extra sticks out one side.

Optional

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

2 cm (1 in)
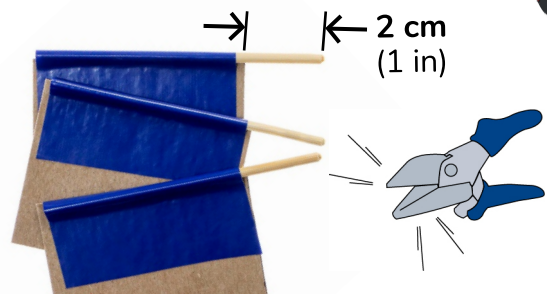
11 **Screw** the hub **cover** to the **base** using a **hub screw.**
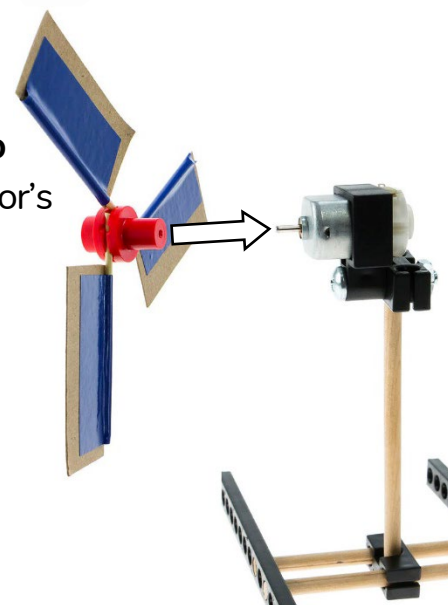
Hub Screw   Hub Cover   Hub Base

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

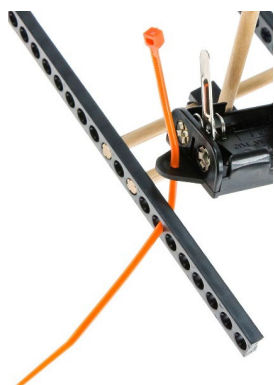**12** **Loosen** the **screw** just enough to **slide** in your **blades**, then **retighten** the screw.

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

TeacherGeek

Power-Up!

14 Put the **zip tie** through the **battery holder** and one of the holes on the **frame**.
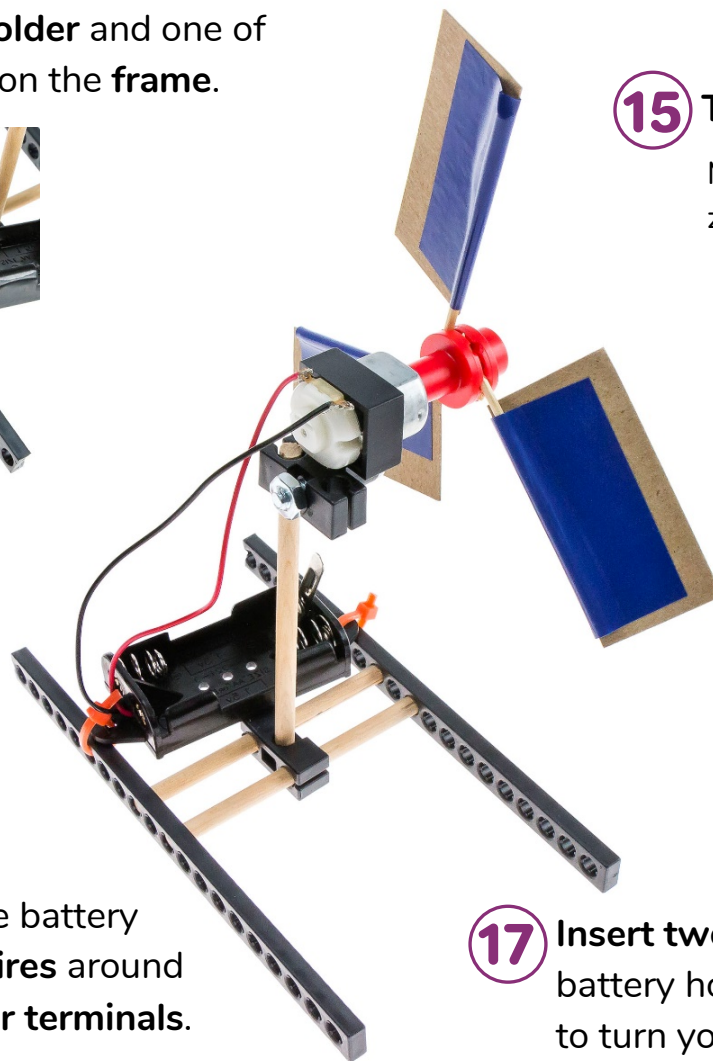
15 **Tighten** and **trim** zip ties.

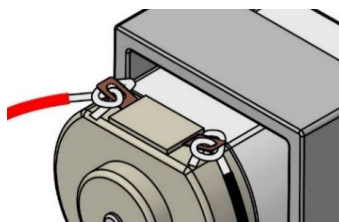Make sure you put the zip ties on the right way!
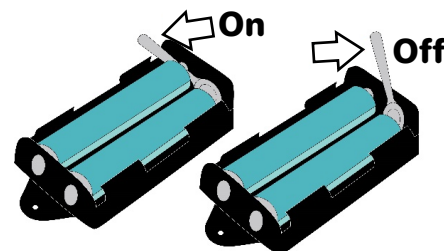
Right!

_____
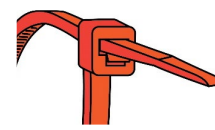
Wrong

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.
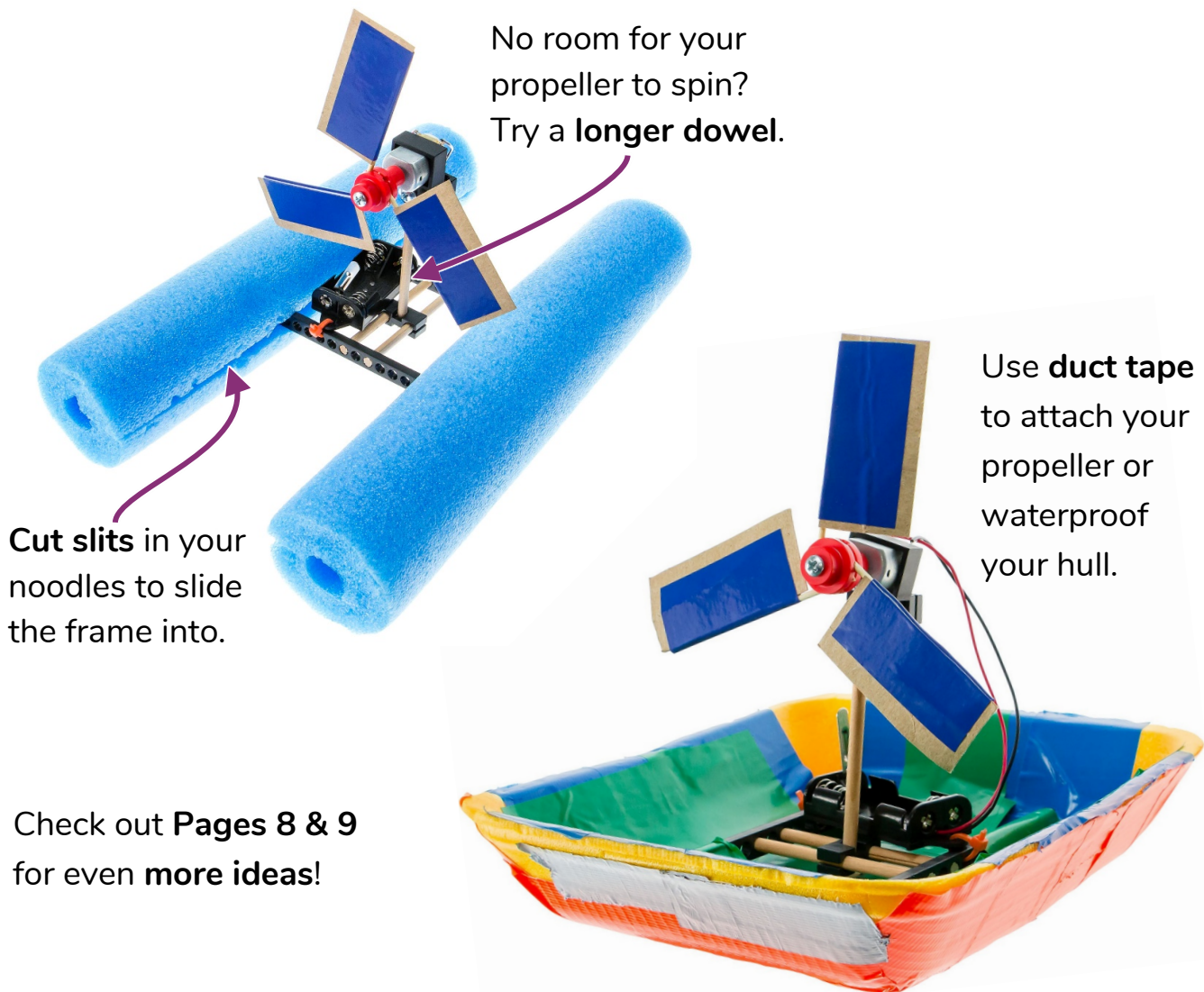
On **Off**

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.

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

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

Cut slits in your noodles to slide the frame into.

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

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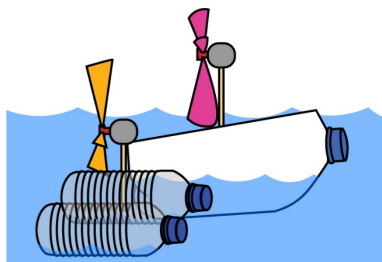test it and tinker with it to **make it better**!

Want to learn more about Propellers using your Boat?

Download the **Propeller Design Lab** at **teachergeek.com/boat**
Ages 8+

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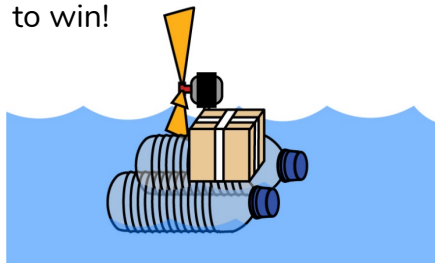
 Your boat must be both above the water and right-side-up when crossing the finish line.

- - - **Additional Challenges** -
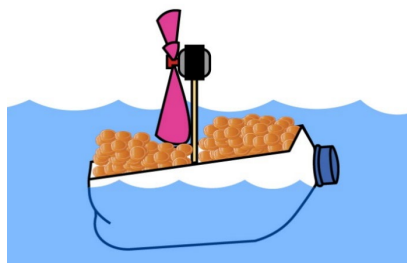
Delivery Challenge

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.
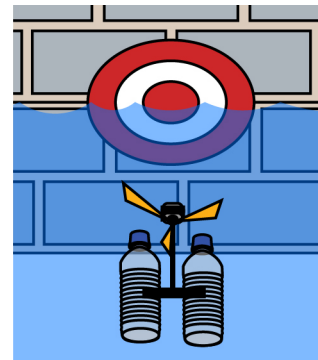
Heavy Load Challenge

Carry the most cargo across the finish line to win!

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

Target Challenge

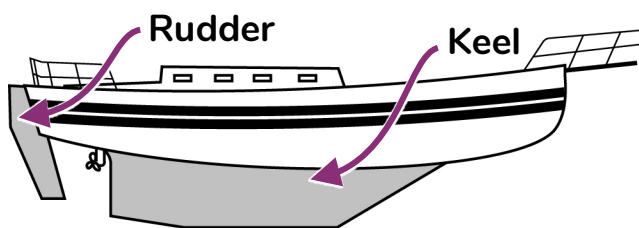The closest boat to the target wins!

Improve the Hull

Make it Track
(go straight)

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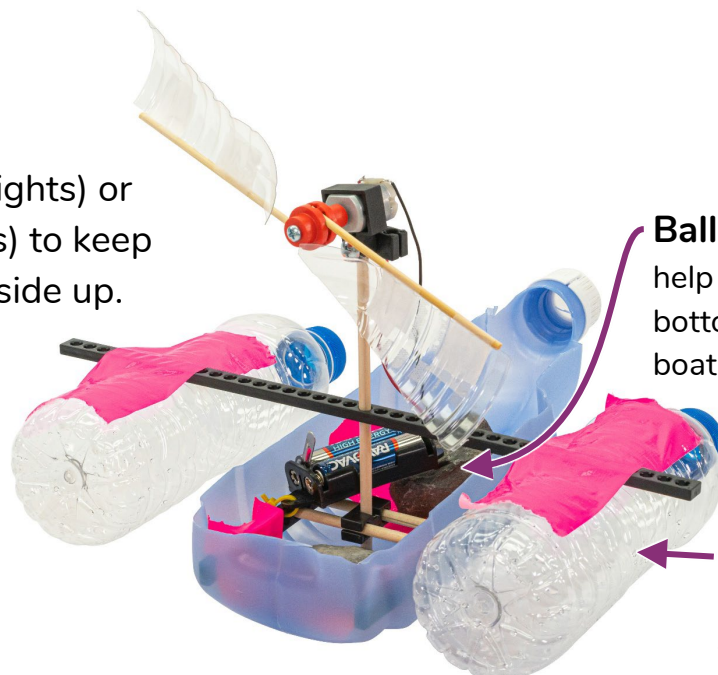
Rudder   Keel

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.

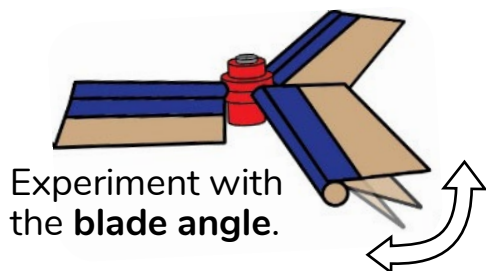**Ballast** (rocks) help pull the bottom of the boat down.

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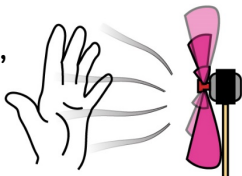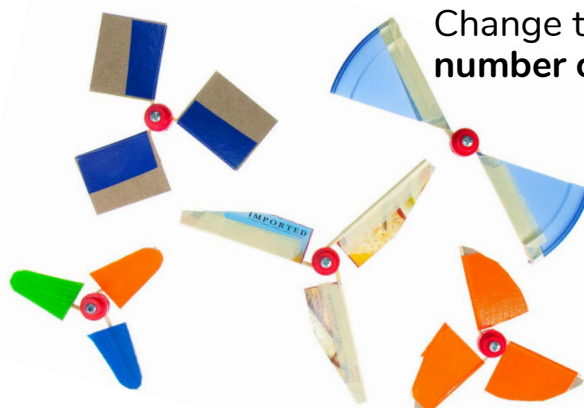
Improve the Prop

Adjust your Propeller

Experiment with the **blade angle**.

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

Change the **number of blades**.

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

Try **different sized** blades.

Test blades with **different shapes**.

Try Underwater Propellers

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

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