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.

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

### BOAT PARTS

These are the parts you need to build one Boat.

<table>
<thead>
<tr>
<th>NAME</th>
<th>QTY</th>
<th>PICTURE</th>
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<td>10 cm (4 in)</td>
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<tr>
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### 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

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

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.

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**Safety First!**
Wear eye protection during these steps and when operating your Boat.

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**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.

Cut slits in your noodles to slide the frame into.

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!
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 **pontoon**s (floats) to keep your boat right-side up.

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

**Pontoon**s (bottles) help push the top of the boat up.
**Go Guide**  
*Build-a-Boat*

**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.

**Try Underwater Propellers**

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

- **Test different materials** – what’s in your recycling bin!
- **Change the number of blades**.
- **Try different sized blades**.
- **Test blades with different shapes**.
- This **water wheel** is only underwater for half its rotation.