



Sail Away

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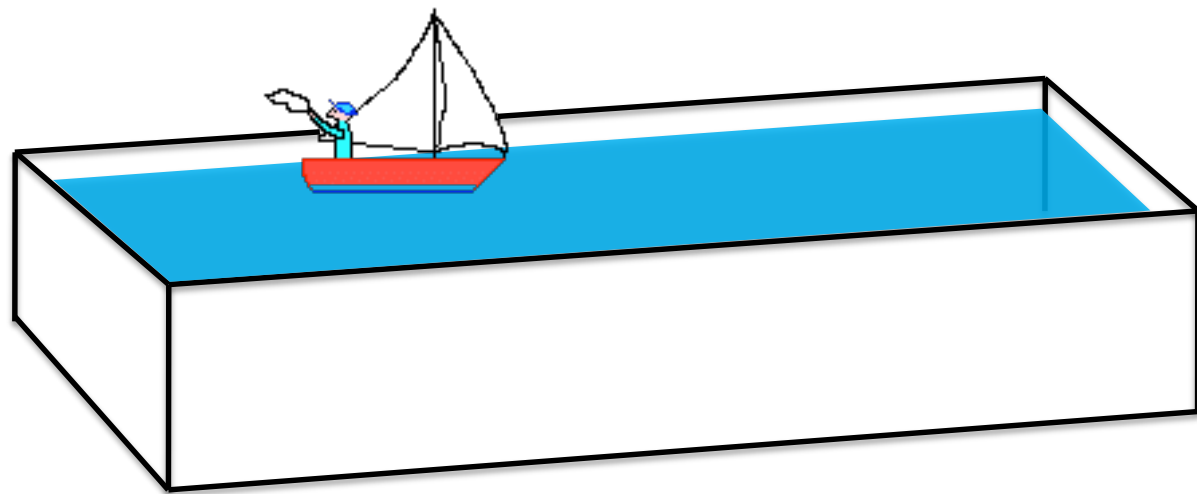
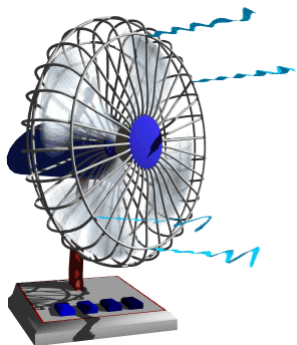


Sail Away Lesson

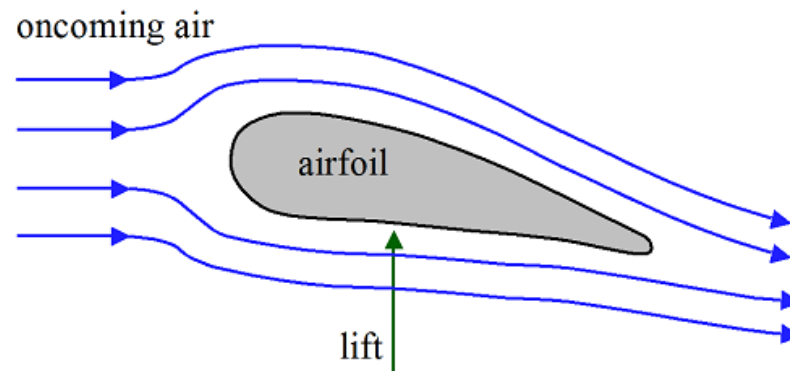
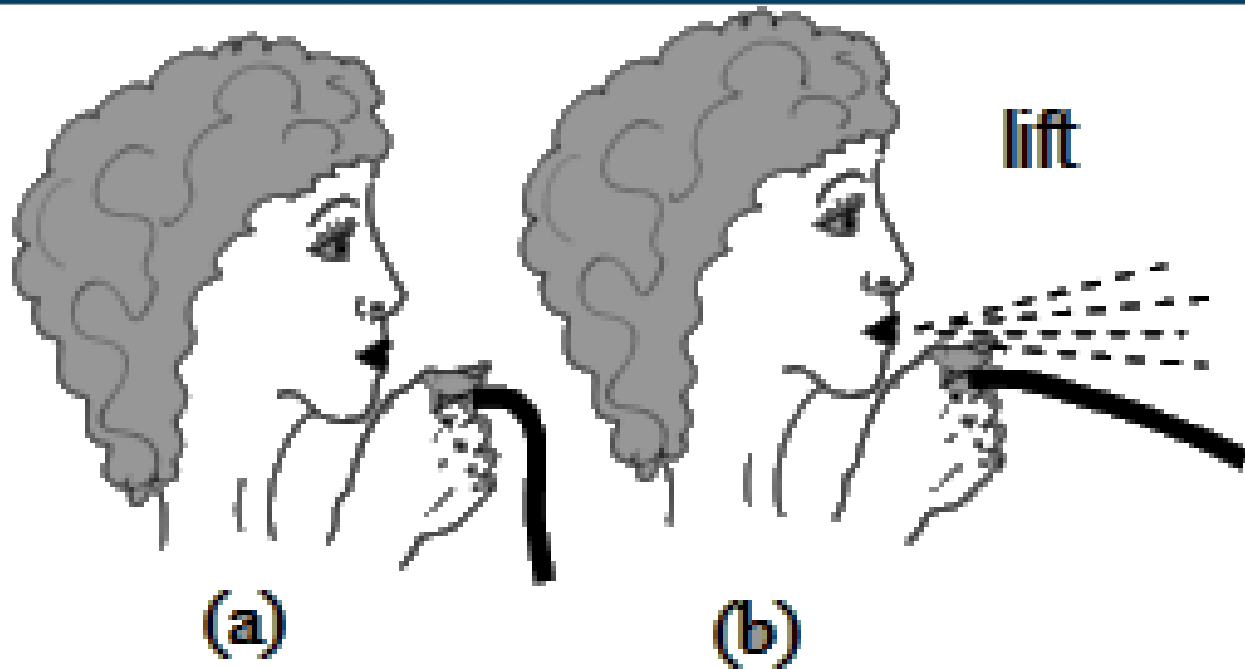
▶ Lesson Synopsis

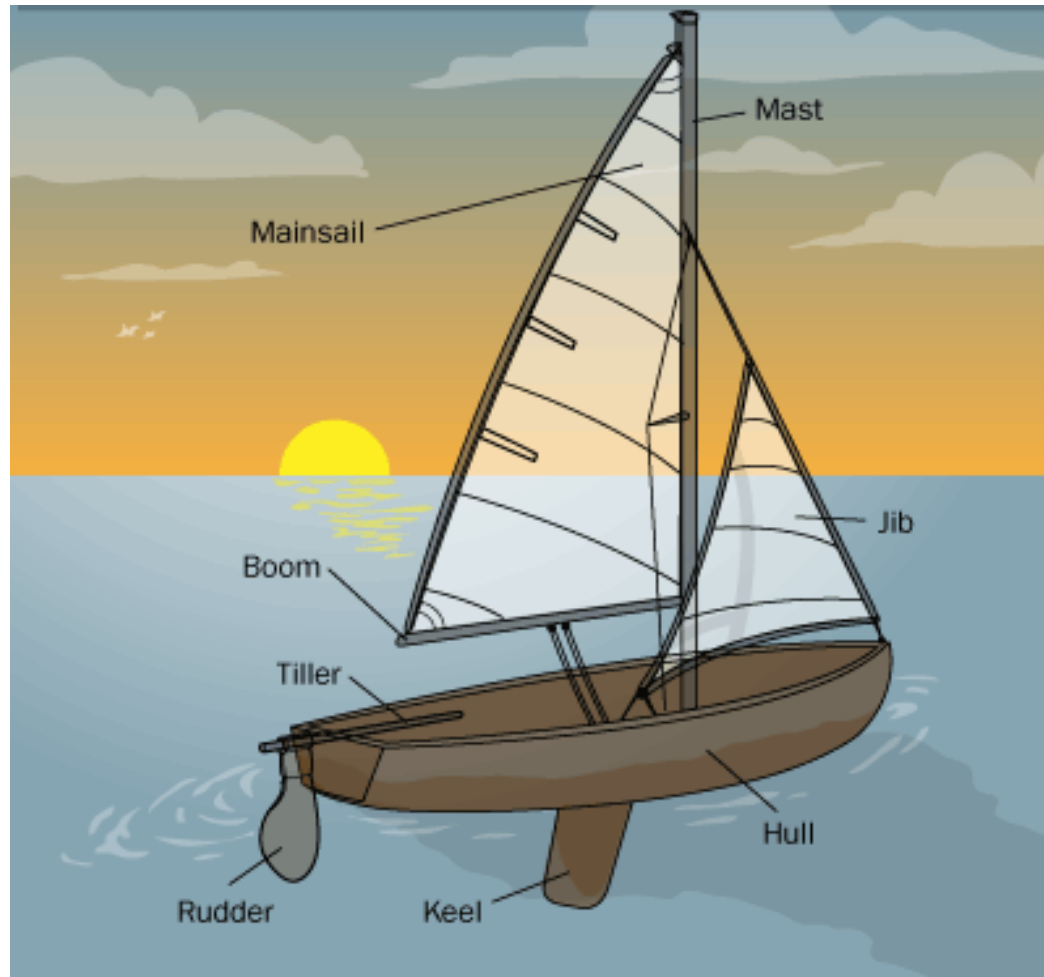
- Working in teams, students design a sailboat out of everyday objects that can harness wind energy from a fan breeze, stay afloat with a set load, and sail a set distance without sinking

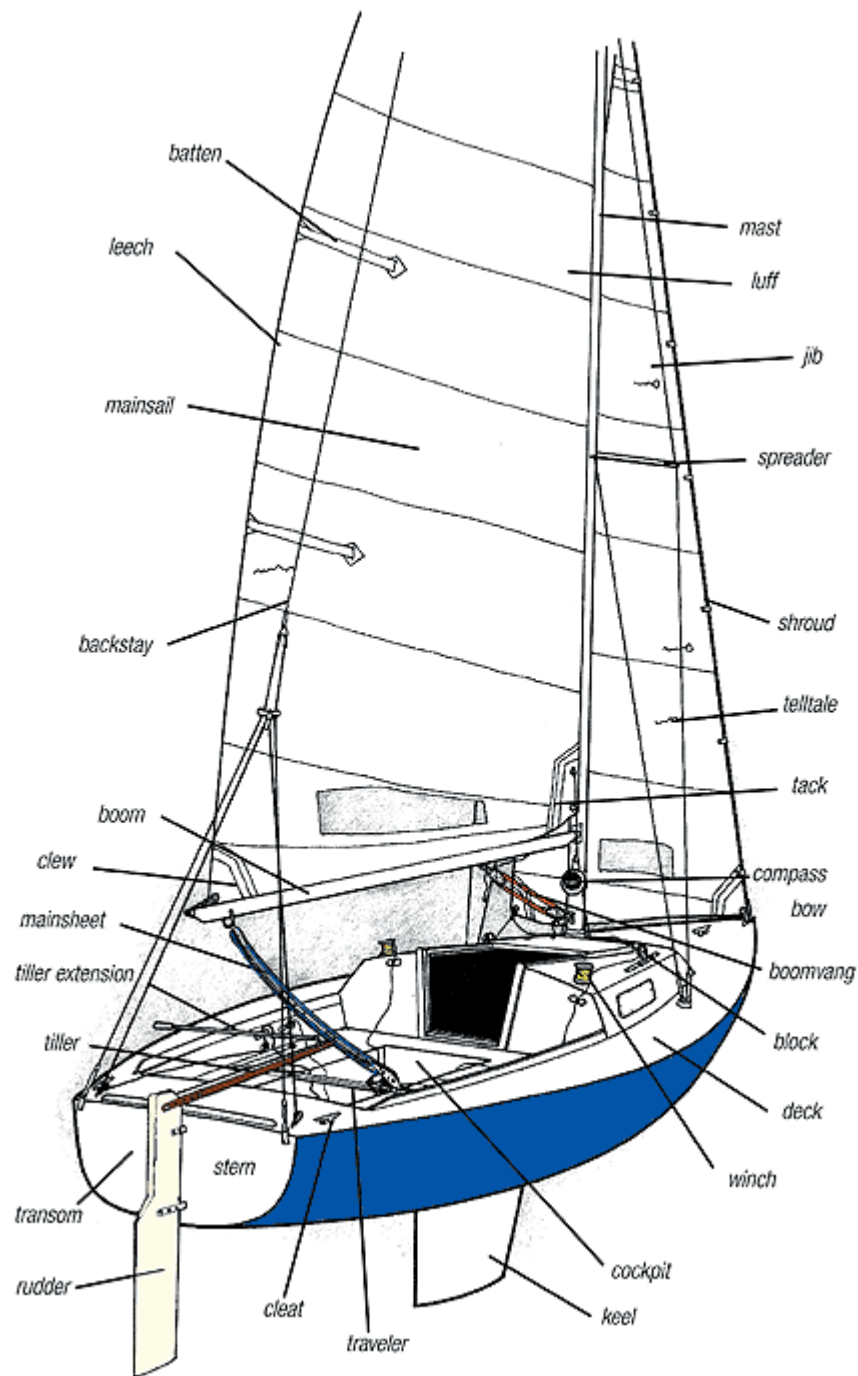




Demonstrating LIFT







Identifying the Key Parts

Hull

The primary structural body of a vessel, not including superstructure, masts or rigging

Keel

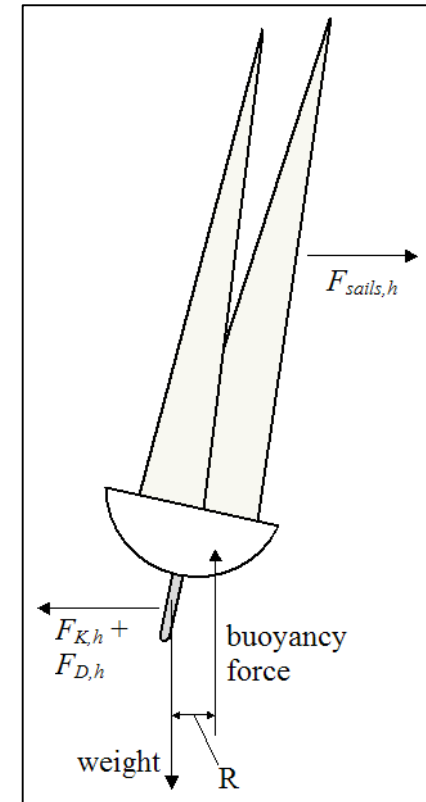
A boat's fixed underwater part used to prevent sideways drift and provide stability

Rudder

A boat's movable underwater steering board

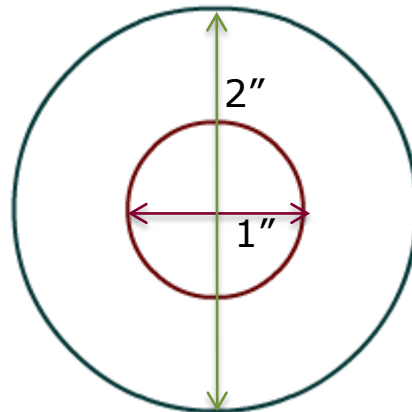


Tilting



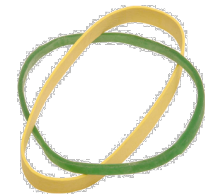
Your Challenge

- **Design a sailboat that...**
 - Has the **smallest** sail area possible, but still
 - Travels the length of the trough (**33.5 inches**) in less than **10 seconds**, and
 - Supports a payload of **four washers of total weight of 5.6 oz**
 - Washers should not sink the boat nor be dropped



Materials

- **Plastic water bottles**
- **Aluminum Foil**
- **Cardboard**
- **String**
- **Binder clips**
- **Plastic wrap**
- **Toothpicks**
- **Craft sticks**
- **Rubberbands**



Procedure

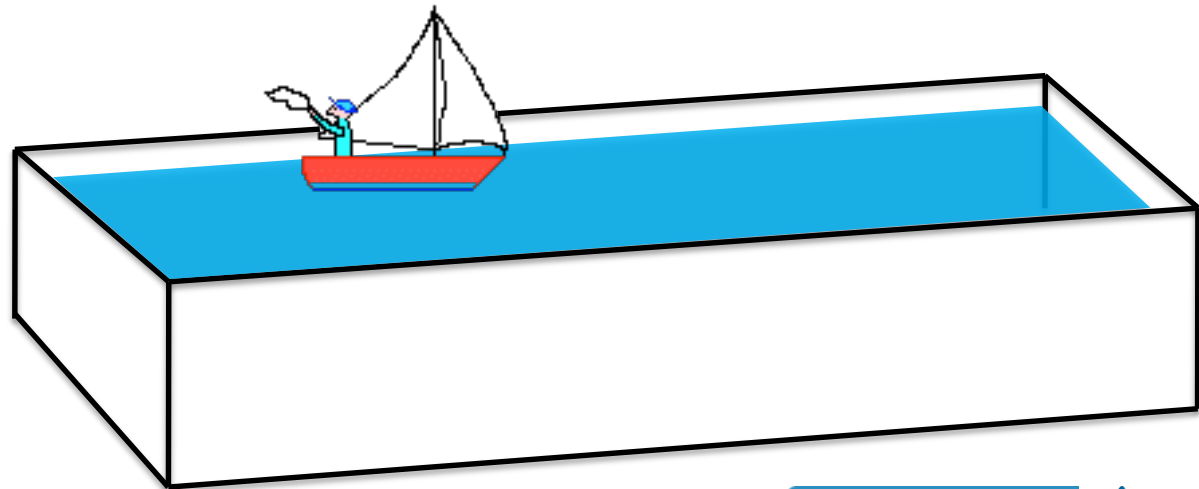
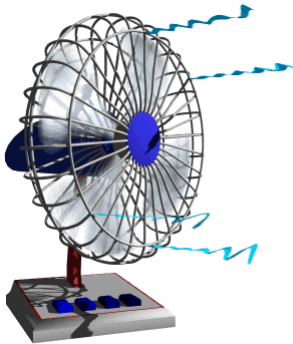
- **Divide into teams of 2 or 3 members**
 - Your group consists of you neighbors at the table
- **Review the requirements**
- **Discuss a solution and create a **sketch** of your design**
 - Create at least one sketch before you start building
- **Build a model of your design with given materials**
- **Sketch the built model, **provide the measured sail area****
- **Test your model**

Testing Procedure

Goal 1: Smallest sail area possible

Goal 2: Travel time less than 10 seconds

Goal 3: Carry weight
(without sinking or dropping the weight)



Reflection

- ▶ Were you able to create a boat that could hold weight, catch the wind, and travel a distance?
- ▶ If you did, did you need to rework your boat during the testing process?
 - What did you need to change about your boat to make it meet the challenge?
- ▶ What aspects of other team's boats did you find interesting? Where there aspects of other designs you wish you had incorporated into your own team's boat?

References

(websites with information on the physics of sailboats)

- › <http://www.real-world-physics-problems.com/physics-of-sailing.html>
- › <http://physicsbuzz.physicscentral.com/2015/05/the-physics-of-sailing-how-does.html>
- › <http://newt.phys.unsw.edu.au/~jw/sailing.html>
- › Sailing Simulator:
<http://www.nationalgeographic.com/volvooceanrace/interactives/sailing/index.html>
- › <http://physicsforarchitects.com/sailing-against-the-wind>

QUESTIONS AND COMMENTS

