



Airboats and how they work

**Lesson developed by:
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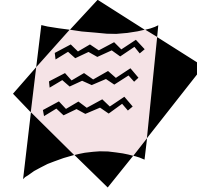


Airboats and How They Work

By Eileen Tan

Abstract

Students learn about Newton's Laws of Motion and proceed to construct their own airboats.



Equipment

1. One Balloon
2. One Stiff Drinking Straw
3. One Sheet of Writing Paper
4. One Small Rubber Band
5. Sticky Tape



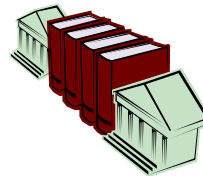
Grade Level



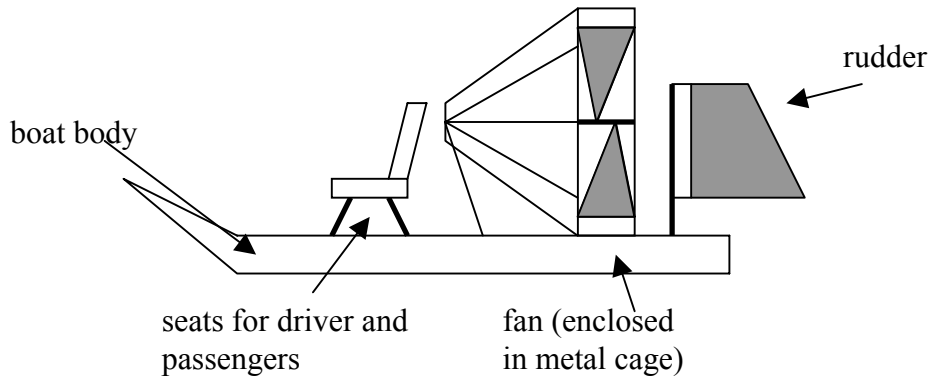
This activity is suitable for Middle School Students

State Standards Met

Standard 1 – Analysis, Inquiry, and Design
Standard 4 – Physical Setting and Living Environment



An airboat is basically a boat propelled by a giant fan. Since an airboat does not rely on an outboard motor and a rudder for propulsion and control, the base of an airboat can be made completely flat. This allows the airboat to travel over places where normal boats cannot go, such as shallow rocky water, swamps, ice and sometimes-even grass.



How does a giant fan push an airboat forward? Newton's Laws of Motion will help us answer that question.

Action and Reaction - Newton's Third Law

Sir Isaac Newton, an English mathematician and scientist, wrote down three Laws of Motion to describe how objects move and interact with each other:

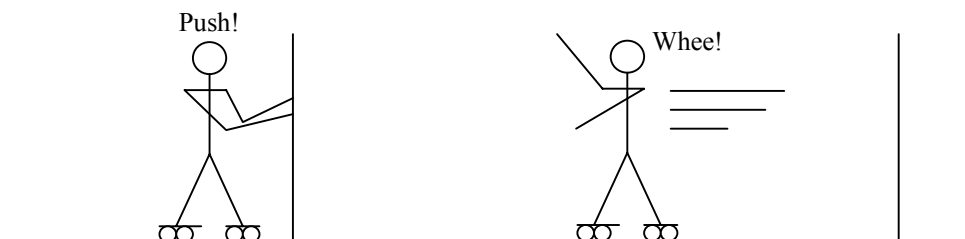
First Law: An object that is still will remain still, and an object that is moving in a straight line will continue moving in a straight line, unless a force acts upon it.

Second Law: The acceleration of an object is proportional to the force that acts on it.

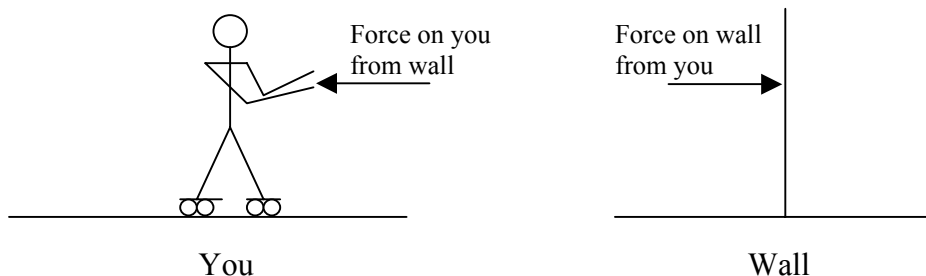
Third Law: If one object exerts a force on a second object, the second object will exert an equal and opposite force on the first object.

Let's look at a few examples to see how Newton's Third Law works.

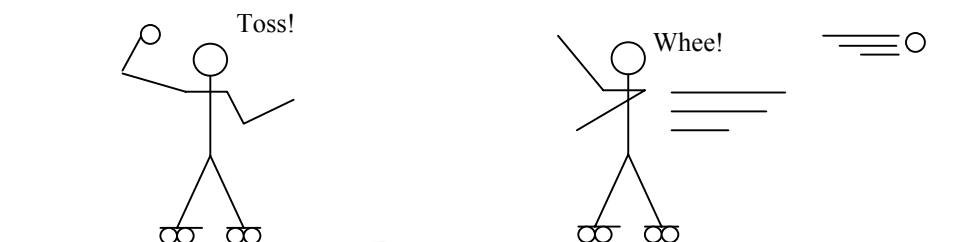
Suppose you are wearing a pair of roller skates, and you're standing still next to a wall. One way of getting yourself to move is to push against the wall. How does this work?



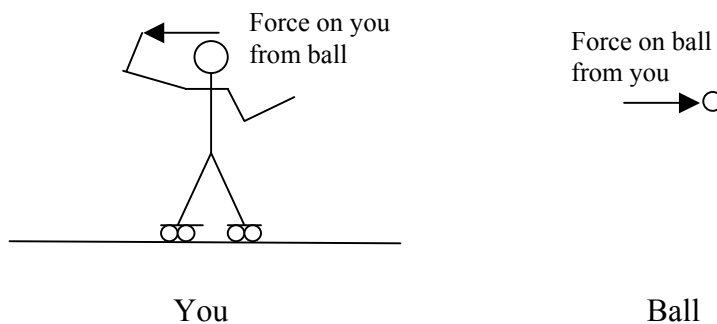
When you push against the wall, Newton's Third Law says that the wall must exert an equal and opposite force on you. That is, the wall pushes on you just as hard as you did on the wall.



Now suppose there isn't a wall, but instead you have a ball. You still can get yourself moving by throwing the ball away!

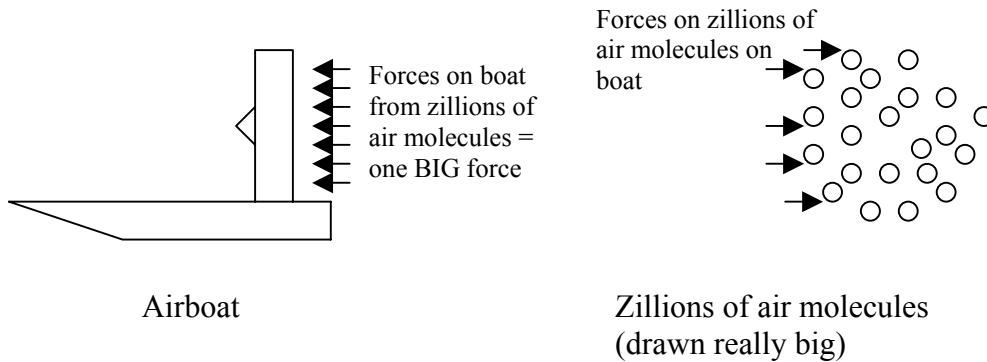


This works in the same way. You exert a force on the ball, and the ball exerts an equal and opposite force on you.



And if you had a box of balls, you could keep throwing balls and pick up more speed.

Airboats work the same way. Instead of throwing balls, they throw air molecules backwards. Each molecule only pushes the airboat by an extremely small amount, but if zillions of molecules push, that adds up to quite a considerable force!



Also, unlike a person on roller skates with a box of balls, an airboat doesn't have to carry the air molecules it tosses out. The giant fan on the airboat collects the air molecules in front of it and tosses them out the back of the airboat.

Rockets work the same way, but since there's no air in space, they have to carry their own air (vaporized rocket fuel) to throw out.

A Balloon Powered Airboat

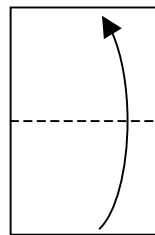
Let's now build a model airboat. We won't put a fan on our airboat; instead, we'll use a balloon to provide the force that pushes our airboat forward.

What you need:

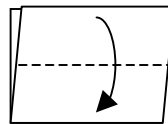
- one balloon
- one stiff drinking straw
- one sheet of writing paper
- one small rubber band
- sticky tape

Making the boat body

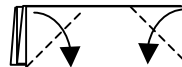
1. Fold the sheet of writing paper in half.



2. Fold in half. Repeat behind.



3. Fold down the corners. Repeat behind.



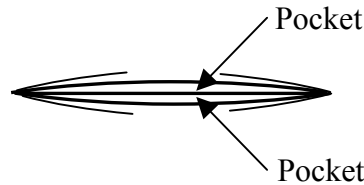
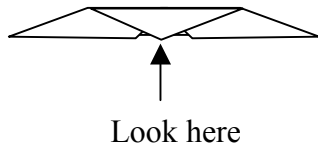
4. Fold down the edges again (there will be some overlap at the centre). Repeat behind.



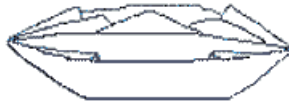
5. Fold the tip down. Repeat behind.



6. You should see two pockets when viewing the model from below. Put one thumb into each pocket, and turn it inside out.

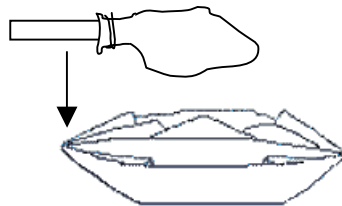


7. Finished boat.



Making the airboat propulsion system

1. Cut off a two-inch segment of the stiff drinking straw.
2. Insert the segment into the mouth of a balloon, leaving about an inch outside the balloon. Use a rubber band to hold it in place. The rubber band should be snug around the straw, but not so tight that it crushes the straw.
3. Attach the straw to one end of the boat body with sticky tape.



4. Inflate the balloon with a pump and let the airboat go!

Questions to think about

The model airboat

1. What determines how far the model airboat travels?
2. Can you improve the model airboat so that it travels (a) faster, or (b) further?

Actual airboats

1. How do airboats change direction?
2. Why is the fan mounted at the rear of the airboat instead of in front?