Hovering On A Cushion Of Air

Objective:	To build a small hovercraft, and to demonstrate how hovering on a cushion of air reduces friction.

Grade Level: 5-8
Subject(s): Science, Technology
Prep Time: < 10 minutes
Duration: 45 minutes
Materials Category: Common household

National Education Standards	
Science	2a, 3b, 6a
Mathematics	
Technology (ISTE)	
Technology (ITEA)	8c, 11d, 11e, 12a
Geography	

Materials:

- Student Sheets
- Hot glue gun
- Old, unwanted compact disks (CDs)
- Balloons
- Pop-up tops from dish soap bottles or sports water bottles
- Science journals

Related Links:

None

Supporting NASAexplores Article(s):

Two-Ton Hockey Pucks
http://www.nasaexplores.com/show2_articlea.php?id=03-071

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Teacher Sheet(s)

Pre-lesson Instructions

- Duplicate the Student Sheets.
- Ask students to bring in old CDs and pop-top bottle caps.
- Prepare a long smooth surface where students can test their hovercrafts. A table top or smooth floor will work best.

Background Information

One force that we deal with on Earth that is not a problem in space is friction. Friction is the force that makes it difficult for one object to slide over another. Friction occurs when a surface has even the smallest hills and valleys. All surfaces have some type of bumps or grooves; there is no totally smooth surface.

When two surfaces touch, each of their hills and valleys rub against those of the other and cause friction. The rougher the surface, the more friction the object will create.
In space, there is no friction. This can pose a problem when astronauts are moving large objects. On Earth, when we push an object, the friction will slow it down until it eventually stops. In a microgravity environment, if you push an object, even nudge it a little, the object continues to move, and is difficult to stop or even to change its direction. For this reason, NASA uses the Precision Air Bearing Floor (PABF) to simulate the lack of friction in microgravity. Here, astronauts practice moving large objects without letting them get away.

A hovercraft, which is also known as an air cushion vehicle works in the same way as the PABF. Air is pumped underneath the hovercraft, causing the craft to lift off of the surface. This cushion of air reduces friction. A hovercraft can move over any surface, including water.

In this lesson, students will build a small hovercraft to demonstrate how it floats without friction.

Guidelines

1. Read the 5-8 NASAexplores article, “Two-Ton Hockey Pucks.”
2. Discuss the article and how the pads underneath the large objects cause them to hover because of the air that is pumped through the pads. Point out that this is different from an air hockey table that has the air pumped from the table itself.
3. Distribute the Student Sheets. Go over the instructions, and answer any questions the students may have. Discuss the safety precautions that need to be taken when working near the hot glue.

4. Pass out materials for the hovercrafts. This experiment can be done individually or in pairs.
5. Allow students to perform the experiment over a variety of surfaces. Students will notice that they have to give the hovercraft a little nudge to start the motion.
6. Have students answer the questions at the end of the Student Sheets.

Discussion / Wrap-up

- Discuss how well the hovercrafts worked, and what are some things they could have done differently to have a more successful flight.

Extensions

- Let the students measure the distance that the hovercrafts travel, and time the flight. Then, they can calculate the speed using the formula: speed = distance ÷ time.
- Build a hovercraft the will hold one person. There are several Internet sites with simple directions on how to make one.

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Student Sheet(s)

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Materials

- Hot glue gun
- Old, unwanted compact disk (CD)
- Balloon
- Pop-up top from a dish soap bottle or sports water bottle
- Science journal

Procedure

1. Place the CD on the table, shiny side up. Place the water bottle top over the center of the CD.
2. Have your teacher hot glue the water bottle cap to the CD (glue around the cap to the CD) within the ridge.
3. Allow the hot glue to dry for about 10-15 minutes.
4. Place a balloon over the top of the bottle cap so that it covers the ridge on it (if there is one).

5. Blow up the balloon through the hole in the CD on the other side of the CD while holding the balloon onto the cap.
6. Pinch the balloon closed to keep the air from escaping.
7. Place the hovercraft on a flat surface, and release the balloon.
8. Test the hovercraft over other surfaces.
9. Test the hovercraft with different amounts of air.
10. Answer the following questions in your science journal.

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1. What causes the hovercraft to float above the surface?
2. How does releasing the hovercraft over different surfaces change it?
3. What do you have to do to get the hovercraft to move?
4. How does this compare to NASA's PABF?
5. How do differing amounts of air affect the flight of the hovercraft?