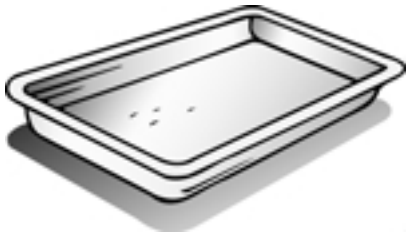
Chapter Science Investigation Name _____

Pushing and Pulling Boats

What You Need



foam food container

sharpened pencil

string

pennies

tub of water

Find Out

Do this activity to see how the size of a load affects how an object moves.

Process Skills

Observing
Communicating
Predicting
Interpreting Data

Time

- 10 minutes to get started
- 1 hour of experimenting and recording

A take-out food container cut in half will work for this activity. One student can use the lid and another student can use the bottom. Students can do this activity in a sink, in plastic tubs, or buckets full of water. Metal standard masses can be substituted for the pennies, if available. If a balance is available, students can record how changes in the mass of the load affects the boat's movement.

What to Do

1. Carefully poke a small hole in one end of the foam container with the pencil.
   Safety! **Be careful with sharp objects.**
2. Tie a piece of string to the container. Put the container in the water.
3. **Observe** and **record** what happens.
4. **Observe** what happens if you tap the container with your hand.
5. Put five pennies in the container. **Predict** what will happen when you push and pull it.
6. Add five more pennies. Push and pull the container again.
7. Continue adding pennies and **observe** and **record** what happens.

Mark an *X* to show if you pushed or pulled.
Record the number of pennies you used and **record** what happened each time.

Push	Pull	Number of Pennies	Result

Student data will vary, but students should observe that as the size of the load increases, more force is needed to push and pull the container.

Conclusions

1. What happened when you pushed and pulled the boat?

The boat moved when it was pushed or pulled.

2. When did the boat need more force to start moving?

The boat needed more force to start moving when it had more pennies.

New Questions

1. Do you think that it would be easier to push or pull your boat in the water or on a table?

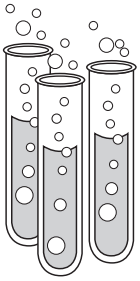
The boat would move easier in the water than on a table.

2. Why do you think this?

The water has less friction than a table.

3. Write a new question you have about pushes and pulls.

Accept all questions.



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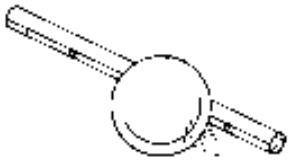
ACTIVITY

Observing Movement



Measure how far the ball moves.

1. _____ **5.** _____

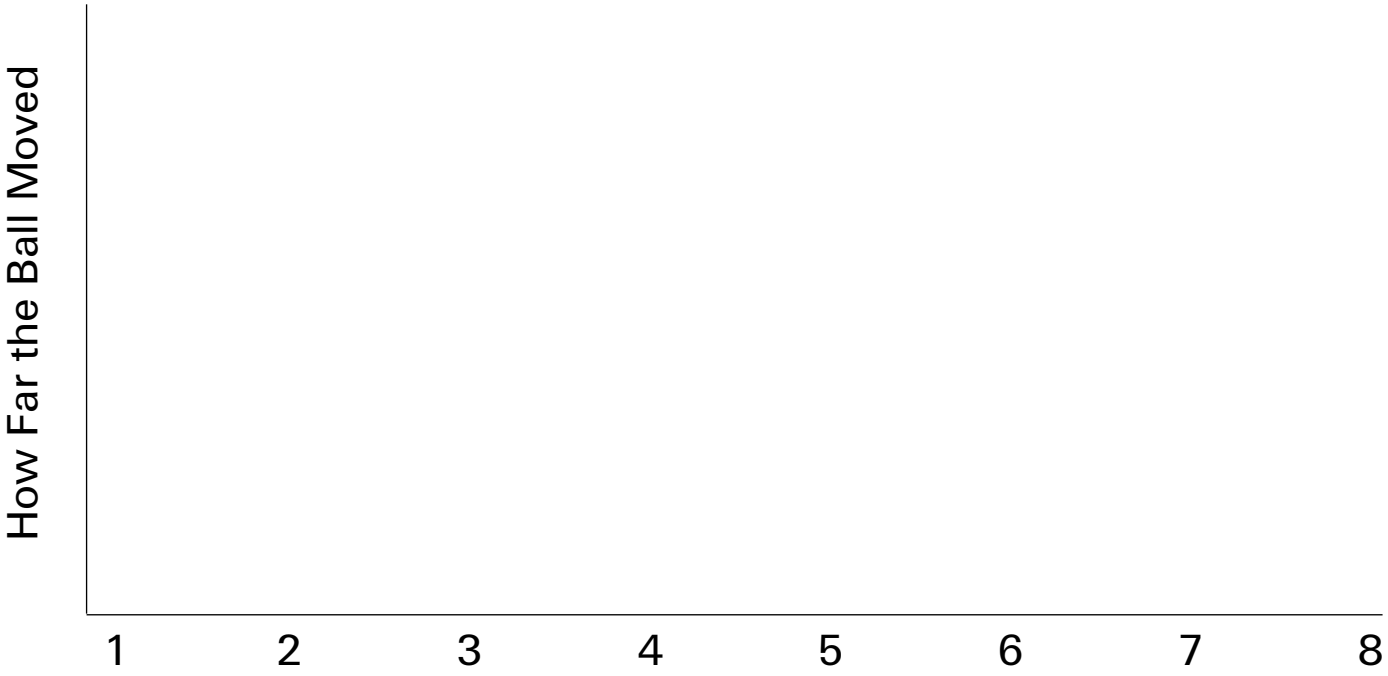
2. _____ **6.** _____

3. _____ **7.** _____

4. _____ **8.** _____

Students' measurements will vary.

Make a graph of your measurements.



Students' graphs will vary but should be based on their measurements.

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What Happened

How far did the ball move each time?

Answers will vary depending on students' experiences.

What pushed on the ball to make it move?

air

What If

What other forces could move the ball?

Accept any reasonable answers.

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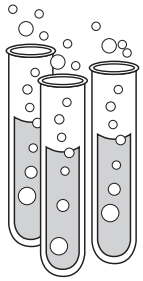
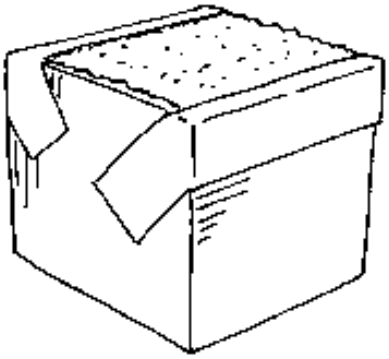
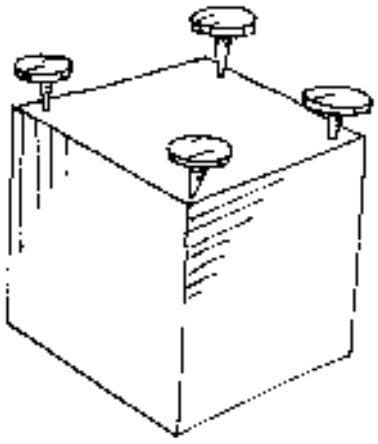


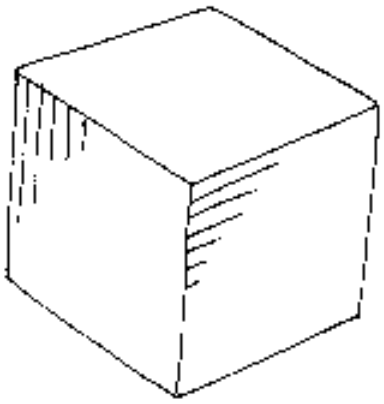
ACTIVITY

Investigating Friction

Write an *x* on the block that moved first, after you tilted the board.
Students should draw an *x* on the block with the thumbtacks.







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What Happened

1. Which block moved first? Which block moved last?

The blocks with the tacks should move down the ramp first, and the blocks with the sandpaper last.

2. Why didn't all of the blocks move as soon as you started to raise the board?

The blocks begin moving at different times because of the different materials on the blocks. The sandpaper and tacks cause different amounts of friction.

What If

How could you change the blocks or the ramp to create less friction?

Answers will vary. Possible answers include: waxing or oiling the blocks or the ramp, or using wheels.

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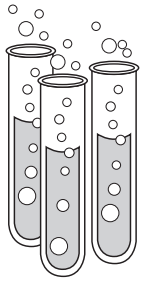
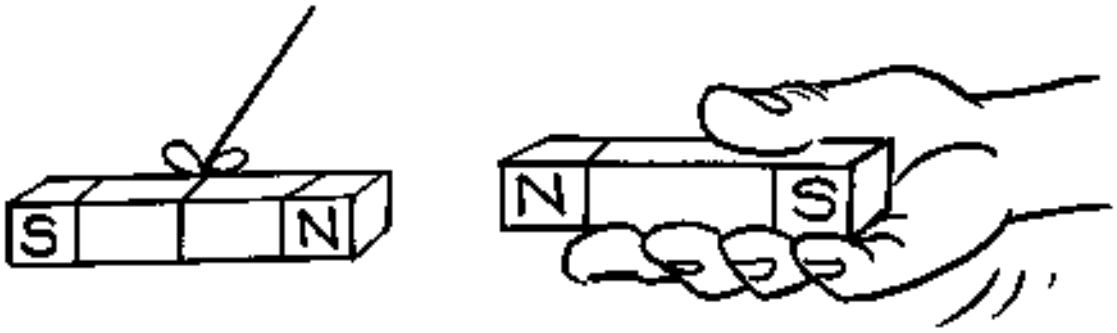


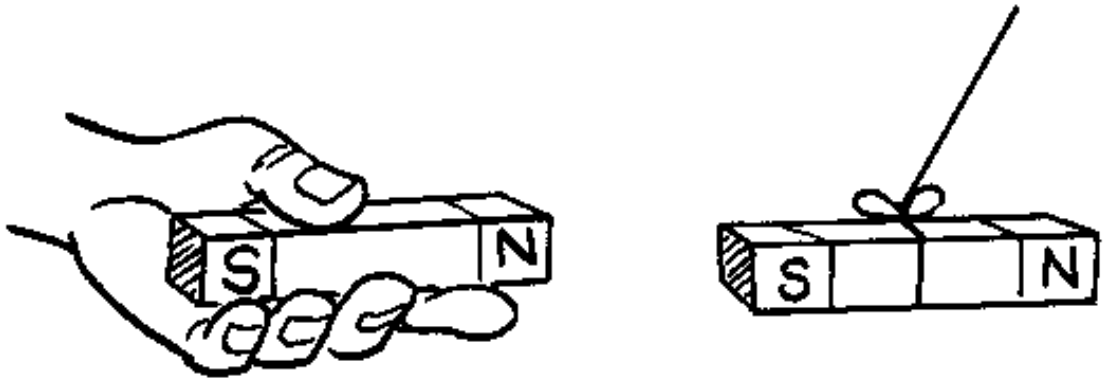
ACTIVITY

Observing Magnets

Draw arrows to show how the magnets moved.



Arrows should indicate that the north poles of the magnets repel each other.



Arrows should indicate that the south pole is attracted to the north pole.

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What Happened

1. Which ends of the magnet were attracted? Which ends were not attracted?

The N to S ends of the magnets were attracted. The N to N ends and the S to S ends of the magnets repelled each other.

2. What happened when the ends were not attracted?

When the ends were not attracted, the magnet on the string was pushed around until its other end was attracted.

What If

How could you use these magnets to help you do a job?

Answers will vary but may include that a magnet can make a job easier by reducing the amount of force needed to complete a task.