

## ► Force and Motion

Parent involvement in a child's education contributes to school success. Delta Science Modules offer many opportunities for parents to learn about and participate in their child's science education.

Use these features in the DSM Teacher's Guide to help you develop and encourage parent participation:

### A School-Home Connection Copymaster

This letter for the family should be sent home a few days before you begin the unit. It explains the upcoming science unit, gives some science background information, and offers suggestions for discovering forces and motion at home. The copymaster appears on page 4.

### Science at Home

Ideas for at-home activities that extend and enrich the classroom experience are provided in the guide on pages 21, 38, 46, 54, 63, 71, 89, and 116.

#### p. 21

Invite students to list ten kinds of work they do at home that involve pushing, pulling, lifting, or some other force—for example, pushing the toaster handle, pulling on jeans, lifting a glass of milk, squeezing the toothpaste tube. This could be the beginning of a Work, Work, Work! journal. Or you could invite students to combine their lists. Can the class come up with 100 push-pull ideas?

#### p. 38

Encourage students to conduct their own experiments with levers at home using a ruler as the lever arm, a pencil as the fulcrum, and ten pennies as both the load and the effort. Remind students that they can change the position of the fulcrum, the load, and the effort. How many different ways can they balance ten pennies?

**SCHOOL-HOME CONNECTION**

Date \_\_\_\_\_

Dear Families,

During the next few weeks, we will be getting quite a "workout" in science. That's because the topic of our next science unit is work. In *Force and Motion*, students will learn that work happens when a force moves an object a certain distance. We will investigate how, when, and why work occurs. We will use push-pull meters to measure the amount of force a given task requires. And we will explore how simple machines reduce the amount of force needed to do work.

Studies show that children learn science best by firsthand exploration. The hands-on activities in this unit will bring science alive! In addition, a *Force and Motion* reader will build communication and vocabulary skills, vital parts of science education.

Many of the activities we perform each day involve moving things. For an object to move, a force—a push or a pull—must act on it. Whenever an applied force moves an object, work is done. Machines are tools that help us work by moving objects easier, faster, or farther. Some machines are quite simple, having just one moving part and requiring only the force provided by a human or an animal. It is these simple machines, and how they change the nature of work, that students will build and operate as they investigate force and motion.

The hands-on activities in this unit explore the six types of simple machines. Here are some of the experiments and projects we may do:

- ▶ Use a **lever** to lift a load and discover the tradeoff between force and distance.
- ▶ Use a **wheel and axle** to lift a load and observe the transfer of force.
- ▶ Build gear systems that magnify force by changing direction and speed of rotation.
- ▶ Construct fixed and movable **pulley** systems and observe how they work.
- ▶ Measure the force required to raise an object using an **inclined plane**.
- ▶ Change the direction of applied force by using a **wedge** to lift a load.
- ▶ Compare the amount of force required to drive a nail and a **screw** into wood.

You can help reinforce the concepts of *Force and Motion* at home by being alert to all the "work" your child accomplishes each day. Point out instances of pushing, pulling, lifting, dragging, twisting, pressing, opening, closing, and so on. What moved? How far? What force was applied? Be on Machine Patrol, looking for examples of the six simple machines, powered only by human effort. For our final *Force and Motion* lesson, we will put together a gadget gallery of household objects that make work easier. Any items you could loan to the class would be appreciated. Children will inspect the collection and identify simple machines. (**Safety note:** Bring any tool with an edge or point directly to me.)

When I say, "Great work!" at the end of the unit, I will really mean it.

Sincerely yours,

#### p. 46

Point out that the soles of our shoes provide friction between our bodies and the surfaces we walk on. Show students how to do a sole imprint: cover the shoe sole with a piece of paper and rub over it lightly with a pencil to reproduce the pattern. Then invite them to compare the soles of family members' shoes and bring in to class a rubbing of the sole they think will provide the most friction.

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**p. 54**

Students can make a roller pathway for an air-powered vehicle at home. Have them ask a parent to make a half-inch hole in one end of a shoebox and to put a balloon in the box with the neck sticking out the hole. Lay a row of straws across a table or floor. Blow up the balloon, twisting the end to keep the air inside. Place the box onto the rollers and release the balloon. Which way does the box move? Why? What happens to the rollers?

**p. 63**

Students are likely to be aware of wheels outside, on cars, trucks, wagons, bicycles, and so on. Ask them now to be on the lookout for wheels *inside* the house. See who can find wheel and axle machines in unusual places at home. Let them make up riddles about the wheels and the work they do, and try to stump the class. (“Turn me and you will soon be able to run through the sprinkler. What wheel am I?” *The outside faucet.*)

**p. 71**

Invite students who have bicycles to look for the gear wheels on their bicycles. How many teeth does each gear contain? Based on what they have learned in this activity, which gear turns faster (or fastest) when they pedal?

**p. 89**

Point out to students that inclined planes slope down as well as up. Encourage them to conduct experiments at home on how the steepness of the slope affects objects sliding *down* the ramp. Using a piece of stiff cardboard for an inclined plane and a toy car (or other small wheeled object), have students measure how far the car rolls each time the upper end of the inclined plane is raised a little higher. What do they notice as the inclined plane gets steeper?

**p. 116**

Use the Word Work search puzzle (in the Copymasters section of the guide) as a review of *Force and Motion* vocabulary words. Make a copy for each student, as either a take-home assignment or an in-class project.

## Connections

The last page of every activity includes several ideas for further discussion, investigation, or research. Many of these suggestions are also good family activities. Cross-curricular suggestions for language arts, math, social studies, health, and the arts are featured. Connections also include Science Challenges; Science Extensions; Science, Technology, and Society; and Science and Careers.

## Student Sheets

As they work through a hands-on activity, students complete a student sheet that may show their predictions, observations, recordings, or responses. Students should bring these sheets and/or science notebooks home to discuss with their families. Student sheets are found in the Copymasters section of the teacher’s guide.

## References and Resources

Recommended books and websites for the unit are listed on pages 137–138. You may want to share this information with parents so they can obtain library books or supervise Internet research.

## Community Resources

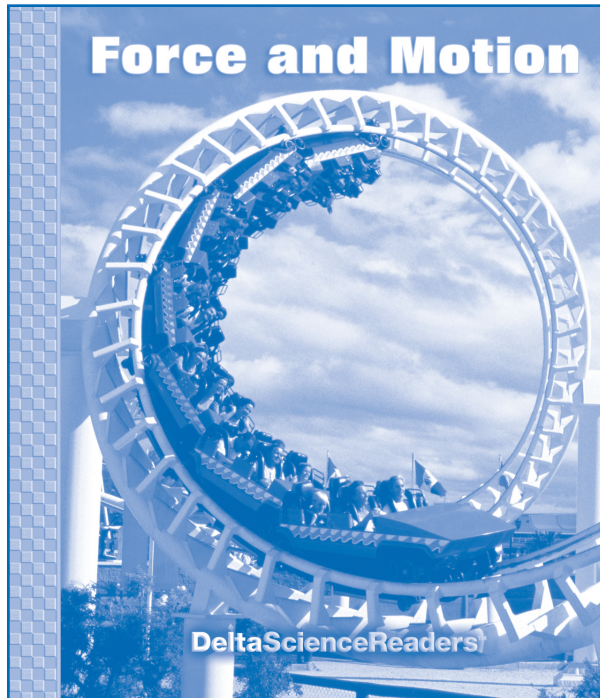
Whether you live in an urban area or a small town, encourage parents to take advantage of local resources with a link to the science unit you are studying. Ask your school librarian or a parent volunteer to compile a list of appropriate science museums, natural history museums, zoos, planetariums, parks (local, state, or national), state divisions of wildlife, local departments of agriculture, or cooperative university extensions.

As well as opportunities for school field trips for your class, they provide a rich experience for family field trips. Contact these community sites ahead of time to see what information they offer about the science unit you are studying.

## Delta Science Readers™

These 16-page nonfiction books for students are a core part of every DSM kit and can also serve as a home-school link. They promote reading in the content area, present key science concepts and vocabulary, and support and extend the experiences of hands-on activities.

Parents can ask students to walk them through a section of the book and to point out the various features (table of contents, glossary, etc.), explain some of the bold words, or describe what the illustrations show. Suggest that parents supervise a website research of one of the scientists mentioned in People in Science or of another scientist the child is interested in.



DeltaScienceReaders™

## Force and Motion

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### Glossary

<b>direction</b> the way an object is moving	<b>newton</b> unit used to measure force
<b>distance</b> how far something moves	<b>pivot</b> to turn around a point, such as a fulcrum
<b>effort</b> force applied to a simple machine to move the load	<b>position</b> where something is located
<b>energy</b> ability to do work	<b>pulley</b> simple machine made of a grooved wheel and a rope
<b>force</b> push or pull	<b>screw</b> simple machine made of an inclined plane wrapped around a center post
<b>friction</b> force caused by objects rubbing together that makes them slow down or stop	<b>simple machine</b> tool with few or no moving parts that makes work easier
<b>fulcrum</b> point that a lever turns around	<b>speed</b> how fast something is moving
<b>gravity</b> force that pulls objects toward Earth	<b>spring scale</b> tool used to measure weight or force
<b>inclined plane</b> simple machine that is a flat surface with one end higher than the other	<b>wedge</b> simple machine with sides that are inclined planes
<b>lever</b> simple machine made of a bar that pivots on a fulcrum	<b>weight</b> a measure of the force of gravity pulling on an object
<b>load</b> object that is being moved	<b>wheel and axle</b> simple machine with a center rod, or axle, joined to a wheel
<b>lubricant</b> slippery material that reduces friction	<b>work</b> something done when a force moves an object a distance
<b>machine</b> tool that makes work easier	
<b>motion</b> change of position or location; movement	

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