Activities

Friction: A Dirtmeister's Science Reporters Teacher's Guide

Grades: 3–5, 6–8

Activity Snapshot
Science is all around us---from a bicycle brake to a pine cone to a flag pole. In "Dirtmeister's Science Reporters," students lead their own investigation in observing, identifying, and describing the science found their world - then write about their findings. With the help of science expert Steve Tomecek (the "Dirtmeister"), students learn to ask scientific questions, communicate their observations, and construct explanations of natural phenomena.

This installment focuses on friction. Students are challenged to find and report on one way that friction works either for or against them as they go about their day. Using the questions on the assignment sheet, students take notes on a "friction event," whether friction is helping to get something done or whether it is making it harder, and what could be done to either increase or decrease the friction. When students complete their observational reports, they turn their notes into a completed report.
Learning Objectives

Students will:

a. Explore, observe, and describe the world around them
b. Identify various phenomena in the real world
c. Investigate materials, organisms, and properties of common objects
d. Construct explanations of natural and man-made phenomena
e. Develop the ability to ask scientific questions, investigate aspects of the world around them, and use their observations to construct reasonable explanations for the questions posed
f. Ask questions about objects, organisms, and events in the environment

Materials (Scholastic Inc. Website)

1. Dirtmeister's Science Reporters Home Page
2. Investigate the Facts (Attachment)
3. Roll With The Changes (Attachment)

Background Information: Friction

In this installment, we explore the force of friction and how it impacts on our day-to-day lives. Like gravity, air pressure, and static attraction, friction is a force that comes into play whenever two objects move. Friction can either be beneficial or it can work against you. When you walk across the ground, it's the force of friction that gets you going. If your feet didn't rub against the ground, you would have nothing to push against and you would go nowhere fast! Of course, when the ground is wet or covered with snow, the amount of friction is reduced - so to help you get a better grip, you wear shoes with deep treads or cleats.
While friction does help us "get a grip," in many cases it's more of a hindrance than a help! Whenever two things rub together, friction takes some of the energy of motion and converts it to heat. This not only slows down things, but means that some energy is literally going up in smoke, which is usually a waste. For centuries, engineers and designers have tried all sorts of tricks to reduce energy losses - due to friction - while moving objects. Unfortunately, on our earth, it's virtually impossible to eliminate "the big rub" - since the air is there, there is always something to rub against! Two key ways that people have used to cut down on friction are: (1) to reduce the surface area between the things that are doing the rubbing, or (2) to use some type of lubricant to make the surfaces more slippery. The easiest way to reduce surface area is to make things smoother. Every lump and bump on the surface of an object adds tremendously to the overall surface area; this in turn increases the friction. By sanding a surface smooth, many of the extra points of contact are eliminated. When a lubricant such as water, grease, or oil is added, the same objective is being accomplished. The lubricant literally "fills in" the tiny holes of a surface, which allow them to slip past each other.

A good place to explore friction is the animal kingdom. How have humans "borrowed" adaptations from animals when it comes to friction? How does a squid compare with a rocket? Do boats and sharks have anything in common? How does the bottom of a snake compare with the bottom of a sneaker? Remember, the animal kingdom was dealing with friction long before there was technology!

You and your students can find out more about friction in the investigate the facts section.

**Extensions**

- Have the class make a list of all the different places where they encounter friction in and around their classroom environment.
- Have students describe how they might be able to decrease the amount of friction working against them when they ride their bikes, use roller skates, or use a skateboard.
For younger students - those in grades K-3 - have them make friction boards by gluing different materials on pieces of wood and rubbing a wooden block against them. Try sandpaper, aluminum foil, felt, wax paper, etc.

**Related Web Sites**

**General Science Sites**
- The Natural History Museum (London)
- Edison National Historic Site
- Endangered Species Program
- National Inventors Hall of Fame
- Understanding Our Planet Through Chemistry
- Maps and References

**Subjects:**
- Friction, Energy, Heat, Mechanics, Technology, Writing
Investigate the Facts

Friction is all around us. Like gravity, friction is a force. More often than not, when people hear the word friction, they think about things rubbing together, and that's exactly what friction is: THE BIG RUB!

Whenever two things rub together, some of the energy they have is lost to friction. Basically, in things like car engines, the wheels of your skates, and the chain of your bike, friction is a force that slows you down. In order to overcome friction, you have to work harder. However, the energy doesn't just disappear — it's turned into heat! Try rubbing your hands together as fast as you can. Pretty soon, they'll be burning up!

As it turns out, the rougher two surfaces are, the more friction there is between them when they rub together. By making things really smooth, or by adding lubricants like grease and oil, engineers work hard to reduce friction and in the long run, save energy.

Friction isn't always bad though. If you've ever tried to start running on a wet floor, you know that too little friction can just make you slip and slide. You need a certain amount of friction to get a grip in order to get yourself going. That's why winter car tires usually have deeper treads than regular tires. The extra grooves make the surface rougher and help them get a grip on ice and snow. Ever wonder why sneakers always have treads on the bottom? They're there to give you some extra grip when you run and play.

Now that we've got you thinking about the force that makes you grip and slip, it's time to observe and record.
Roll With The Changes (Friction)

Why do the tires on your bike roll better when they're all pumped up than when they're soft? And why do your roller blades go better on smooth pavement than on a sandy road? The answer is friction...the big rub! The force that slows you down and gets you going; without friction, you'd be slip slidin' away!

**What To Do**

This challenge involves rolling things and friction. Here's what you'll need to play:

- a big flat board that's at least 6 inches wide and 2 feet long
- a large thick book or a few smaller books totaling about 2" - 3"
- three cans of soup all the same exact size and brand. One should be a cream soup like cream of mushroom, one should be a clear soup like chicken broth and one should be a chunky soup like vegetable or chicken noodle.

Find yourself a big open room. You may have to move some furniture around. Lay your books down on the floor at one end of the room and rest one end of the board on top of it. The board should now look like a ramp.

The ground rules are as follows:

- You must start all the cans from the exact spot on the top of the ramp and you're not allowed to roll them or push them in any way. The only thing that gets them going is gravity!
- Before you try it out, study each can carefully. Then make a prediction about who the winner will be and write down your prediction.
- In order to make sure your results are accurate, repeat the experiment at least three times.
Are You Ready?
Okay, here's the challenge question: Which do you think will roll farther down the ramp, the can of clear soup, the can of creamed soup or the can of chunky soup? (Maybe they'll all go the same distance, after all, they're the same size and shape!)

Observe & Record

Find and observe one way that FRICTION affects YOU in your daily life. Remember, it should be an example that is in your daily experience, such as riding a bus. Print out this page and answer the questions below. When you're done filling in this form, write your report.

Friction Observation Sheet
Your Name: __

1. In what daily instance does friction affect you?

2. What two things are rubbing together?

3. In this particular case is friction helping to get something done or is it making the work harder? How?
4. What could you do to either increase or decrease the amount of friction?

5. Can you think of another similar case in which friction might work the same way?

Related Web Sites

Friction Sites
Science Projects for All Students: Friction Activities
http://www.fsbassociates.com/sciprojects/friction.htm

General Science Sites
Science and Technology for Children Curriculum
http://www.si.edu/nsrc/pubs/stc/overv.htm
The Natural History Museum (London)
http://www.nhm.ac.uk/index.html
Edison National Historic Site
http://www.nps.gov/edis/
Endangered Species Program
Glossary of Terms
Potential Energy: Energy that can be used later. (When you're at the top of a hill, you have potential energy.)
Kinetic Energy: The energy of an object in motion. (Roll down the hill, and you've turned your potential energy into kinetic energy.)
Gravity: The force that pulls things toward the Earth.
Friction: When one thing slides against another, friction slows down the motion.
Drag: Friction between a moving object and the air around it. Drag also slows things down.
Momentum: The "oomph" of a moving object. The more momentum something has, the longer it can keep moving and the harder it is to stop.