Activity 1

No-Slip Grip

PREDICT THE AMOUNT OF FRICTION DIFFERENT SURFACES WILL CREATE.

Friction is a force that resists motion when two objects are in contact. If you look closely at the microscopic surfaces of all objects, there are tiny bumps and ridges. When you try to slide one object over another using just a small amount of force, the object won't move since those tiny bumps and ridges catch onto another. This is called static friction. If you apply a little more force, the object will "break free" and slide, although you still need to apply force to keep the object in motion.

You'll Need:

- 2 feet minimum of surfaces for testing stations (See Smart Start.)
- weights (sand, rocks, etc.) to evenly fill each shoebox 1/3 full
- optional: scale

For each small group

- 1 shoebox
- 1 craft stick or wooden skewer
- 1 sturdy rubber band
- paper and pencil
- masking tape
- 1 measuring tape or yardstick

SMART START:

Low Friction Surfaces
wax paper, tabletop (not wooden), linoleum flooring, ice (fill a cookie sheet with water and freeze overnight)

Medium Friction Surfaces
felt fabric, rubber car mat, corduroy fabric

High Friction Surfaces
sandpaper (24, 30, or 36 grit), rubber stair tread (available at hardware stores), vinyl upholstery fabric

Here's how:

1. Introduce friction. Discuss the concept of friction. Have groups brainstorm times they've noticed the effects of friction.[2] (Examples might include rubbing hands together, walking on ice, or wearing shoes with good traction.) When is friction useful in nature? (Animals that climb trees or walk on ice or snow are great examples.)

2. Predict. Introduce the **SciGirls Challenge:** How does a surface affect how much force is required to move an object? Ask girls to look at the various testing stations and predict whether the surfaces will create more or less static friction.

Watch girls test different materials on the *SciGirls Investigate* DVD. (Select Mother Nature's Shoes: Test Materials.)

3. Prepare a weighted shoebox. This will be the object the girls will try to move over various surfaces. Divide girls into groups of two or three.[1]

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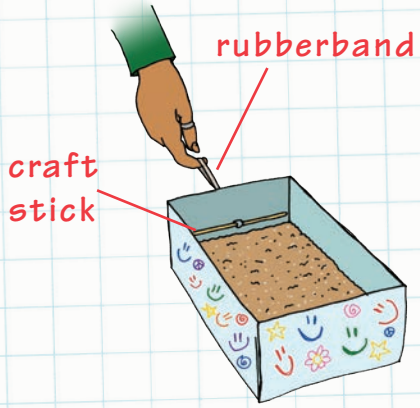
[1-7] See **SciGirls Seven** strategies on page 3.

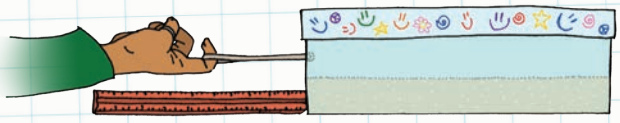
No-Slip Grip continued

Give each group an empty shoebox, a craft stick, and a sturdy rubber band. Have the girls make a hole in the narrow end of the box. Loop the rubber band around the craft stick, place the stick in the shoebox, and pull the other end of the rubber band through the hole so that the craft stick is pulled tight against the inside of the shoebox. (See below.) Then fill the shoebox roughly 1/3 with the weights provided (sand, rocks, etc.). Tape the lid on and decorate.



POINTER: If you want to compare data across groups, you will need a scale to make sure each group's box weighs the same amount.

4. Collect data. Have each group rotate through the testing stations and start by placing their shoebox on the testing surface. Ask each group to measure and record the initial length of the unstretched rubber band. (See below.)



Have a girl use one finger to slowly pull the rubber band straight away from the box, until the box moves. Record the maximum length of the stretched rubber band at the moment the box starts to move. The girls should repeat this procedure three times on each type of surface.

POINTER: Girls should take turns testing surfaces. It helps if one girl pulls the rubber band while the others take measurements and record them.

Rubber bands may snap when testing surfaces that produce a lot of static friction. Be careful.

5. Analyze data. Subtract the initial length of the rubber band from the maximum length of the rubber band for each surface and record. Find the average of the three attempts for each of the surfaces. (See table on following page.)

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No-Slip Grip continued

Force Needed to Move Shoebox

Material	Maximum length		Initial length		Change in length	Average change in length
sandpaper	26 cm 25 cm 25 cm	- - -	10 cm 10 cm 10 cm	= = =	16 cm 15 cm 15 cm	15.3 cm
wax paper	13 cm 14 cm 12 cm	- - -	10 cm 10 cm 10 cm	= = =	3 cm 4 cm 2 cm	3 cm
rubber car mat	19 cm 20 cm 19 cm	- - -	10 cm 10 cm 10 cm	= = =	9 cm 10 cm 9 cm	9.3 cm

6. Share. Ask girls to compare the averages and share their findings with the larger group. Does more stretch mean that there is more or less static friction between the surface and the box? What characteristics of each surface might impact your experiment? [6]

7. Extension. Try testing surfaces you find outside (sidewalk, concrete, grass, etc.) or testing the same surfaces with the girls' shoes to see if the results are similar.

Watch Cindy discuss the difficulties of prototyping on the *SciGirls Investigate* DVD. (Select Mother Nature's Shoes: Mentor Moment.) [7]

Mentor Moment

Cindy Gilbert is a biologist who combines her love of nature with sustainable design at the Minneapolis College of Art and Design. She sees the two fields, biology and design, as bound together by the theme of change. Trained in the field of biomimicry (creating new technologies based on the study of nature), Cindy believes designers hold the key to changing the world for the better.

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[1-7] See **SciGirls Seven** strategies on page 3.