Slippery Soles Engineering Design Worksheet

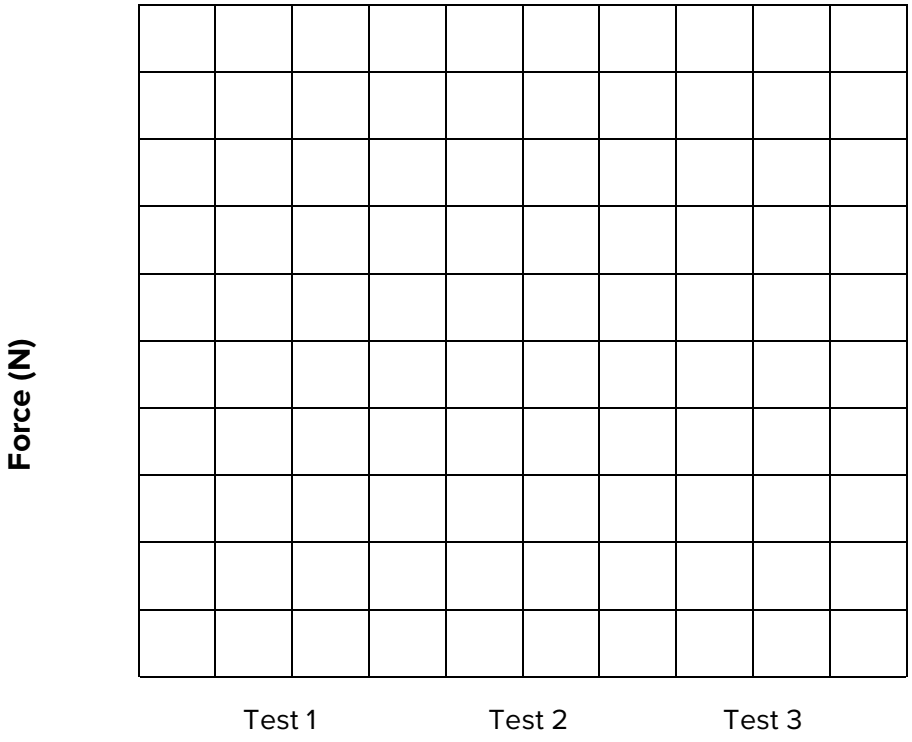
Testing Protocol

1. Using a protractor, prop up the icy ramp to create a seven-degree incline.
2. Weight the shoe.
3. Attach the hooked end of a spring scale to the shoe. Place the shoe on the ice ramp with the heel against the bottom edge.
4. Slowly pull the handled end of the spring scale until the shoe begins to move. In the table below, record the force (in Newtons) needed to drag the shoe up the slope. Plot your result in the bar graph below.
5. Remove the shoe from the ice. Coat the sole in paint.
6. Take a print of the sole of the shoe by pressing it onto 1-cm graph paper.
7. Count the squares on the graph paper that are covered in paint to estimate the surface area of the parts of the tread that were in contact with the ice.

Design Data Table

Test	Force (N)	Surface Area (cm^2)	Notes
Preliminary Data			
Design #1			
Design #2			

Force Required to Pull Each Shoe



Your Challenge

Using common classroom or household materials, redesign the sole of your shoe to increase the friction and the force needed to pull it. Your modification cannot add more than one inch in height to the shoe and must be no larger than the sole of the shoe.

Imagine

List ideas and draw sketches of your design.

Be sure to refer back to your shoe and animal observations and to use data from the materials and surface area tests to inform your design ideas.

Plan

Sketch a blueprint of your final design. Include materials needed and measurements. Draw a view of the tread pattern and a side view of the sole in contact with the ice.

Test

Test your design. Be sure to record your data in the Design Data Table.

By Educator Collaborator Brienne May

Reflect

How did your first design do? Did if perform better or worse than the unmodified shoe?

Revise

Jot down some notes and sketch plans for improving your design. Use your data to guide your revisions. Include materials and measurements in your plan. Show a view of the tread pattern and a side view of the sole in contact with the ice.

Re-Test

Test your second design. Be sure to record your data in the Design Data Table.

Reflect

Based on your data, what features were most effective at increasing friction between your shoe and the ice? How could you use your design to create a marketable product?

By Educator Collaborator Brienne May