



2020 Minor Challenge Set #1

STEM Field: Mechanical Engineering

Level: Intermediate

Challenge Name: Investigating Friction on Surfaces

Materials required:

- Rubber band
- Stack of five or six coins
- Sticky tape
- Smooth wooden surface, such as a table or floor (If you do not have a wooden surface, you can use any other type of smooth countertop or table.)
- Rough carpeted surface (If you do not have access to carpet, you can tape down several paper towels on top of your smooth surface.)
- Ruler (optional)

Introduction:

Ever tried going down a slide at a playground to find you don't slide down as fast as you thought? On an ice skating rink what makes you slow down while sliding on the ice then eventually stopping (other than the wall).

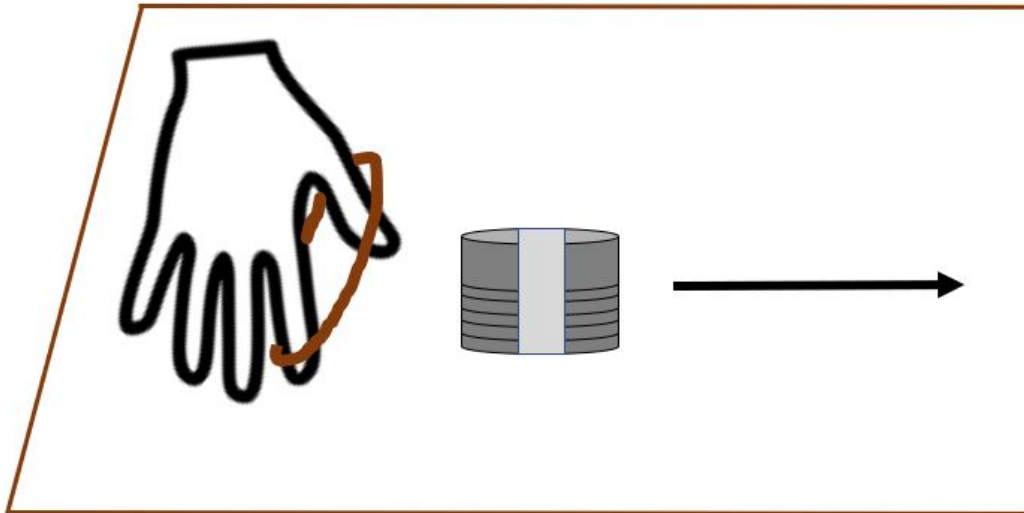
Friction is this slowing force that stops us from skating on ice forever and not so fun slide experiences. The more friction between the surfaces of two objects such as your pants and the slide, the slower you go down the slide. There are a number of factors that determine how strong frictional force can be. An easy one is how smooth the surfaces

are. The blades on a pair of ice skates and the surface of an ice skating rink are both smooth to reduce friction.

In this experiment we will investigate the effects different surfaces have on the movement of a particular object; in this case a stack of coins.

Instructions:

- 1) Put all the coins on top of each other then wrap them in tape so they hold together securely. Make sure the bottom of your stack is smooth as this could interfere with the experiment.
- 2) Ensure the wooden and carpet surfaces you will be performing the experiment on both have plenty of flat space free from obstructions.
- 3) Place a rubber band in between your thumb and index finger then place both thumb and finger on the desired surface (refer to the diagram below).
- 4) Widen the gap between your index and thumb so that the stack of coins can fit in between them.
- 5) Pull back the stack of coins against the rubber band and release it to send the coins across the surface.
- 6) Now repeat this experiment several times across different surfaces and watch how far the coins go. Make sure you pull back on the rubber band the same amount each trial. Which surface causes the coins to go the furthest? Which surface can we conclude to have greater friction?



Extension: Friction of other objects

Instead of using coins, try launching safe objects with a similar shape to the stack of coins such as a rubber. Repeat the same experiment you just completed with the coins. Before you conduct the extension experiment, think about and/or write down what you expect to happen in comparison to the coins. Do you think your object will travel further than the coins on the same surface? Do you think your object will travel differently on different surfaces? Why?

Reflection Questions:

- What were the problems associated with the challenge? Are there any improvements you could suggest?
- What are the key concepts of science and engineering that relate to this challenge?
- What do you think would happen in this experiment if there was no friction between the coins and the surface?

- What kind of surfaces would the coins travel the least distance? How about the most distance?
- In real life there are many cases where having too much friction is bad. What is an example of this case? How about too little friction?
- An object sliding across a surface is just one of many examples of friction. What else can you think of that would be considered friction?

Submission Guidelines:

- Submit a photo of the experiment setup. Include a short summary that addresses some of the Reflection Questions.
- In 2020 we have changed our submission guidelines compared to 2019. To submit fill out the form here:
<https://forms.gle/ChrCXLud97E4x3AT9>

Learn More! Resources:

- Ducksters - Physics for Kids
<https://www.ducksters.com/science/friction.php>
- BBC Bitesize - What is friction?
<https://www.bbc.com/bitesize/articles/zxqrdxs>

Sources:

Scientific American. (2019). Slippery Science: Explore Friction by Launching Stuff. [online] Available at:
<https://www.scientificamerican.com/article/slippy-science-explore-friction-by-launching-stuff/> [Accessed 17 Feb. 2019].