



## Classroom Teacher Preparation

### Physics 19: Friction

Please use the following to prepare for the next SfS lesson.

#### Description:

This lesson provides students with an introduction to friction by exploring the factors affecting friction and discovering two types of friction (kinetic vs. static). Students can explore the differences in frictional forces for different materials or the effect of the weight of an object on the frictional forces it experiences. The concluding discussion allows students to compare their results to those of their classmates in order to gain a more complete picture of the nature of frictional forces. This lesson is geared towards older (6<sup>th</sup>-8<sup>th</sup> grade) students.

#### Lesson Objectives – SWBAT (“Students Will Be Able To...”):

##### 6<sup>th</sup>-8<sup>th</sup>

- Define friction as a force that opposes motion and state two factors that affect its magnitude
- Distinguish between kinetic friction and static friction, and recognize that static friction is larger

#### Disciplinary Core Idea (DCI)

PS2 Motion and Stability: Forces and Interactions – PS2. A Forces and Motion

- (6<sup>th</sup>-8<sup>th</sup>) The role of the mass of an object must be qualitatively accounted for in any change of motion due to the application of a force.

#### Science & Engineering Practice (SEP)

Planning and Carrying out Investigations

- (6<sup>th</sup>-8<sup>th</sup>) Collect data to serve as the basis for evidence to answer scientific questions

#### Crosscutting Concept (CCC)

Patterns

- (6<sup>th</sup>-8<sup>th</sup>) Patterns can be used to identify cause and effect relationships
- (6<sup>th</sup>-8<sup>th</sup>) Graphs, charts, and images can be used to identify patterns in data

#### Preparation:

It is helpful for students to be familiar with the concept of *force*, defined as *the push or pull experienced by an object, as a result of an interaction with another object*.

#### Room Set Up for Activities:

Students will be working in pairs or groups of 3.

Each group will need a clean, flat workspace 2-3 feet long. A table is ideal, but desks or even the floor will suffice. Wet wipes will be available to clean the work surfaces, so that students are able to measure the friction between surfaces, rather than the effect of pencil shavings, sand, or dust bunnies on friction. This will be especially important if students are using the floor as their work surface.



## Safety:

There are no safety concerns for the students with this lesson. Please consider whether tables or the floor would be the better workspace for your students, to minimize the chance of breaking the ceramic mugs.

## Related Modules:

This lesson may be paired with the SfS lesson on *Energy*, as friction is the mechanism for converting kinetic energy to heat (note: this lesson is generally aimed at younger audiences).

*Physics 16: Energy* – This station-based module presents the concept of energy as the ability to do work and familiarizes students with many forms of energy. Students explore various conversions of energy through different activities.

Another example of friction is seen in the *Pendulums* lesson, where students have the opportunity to observe that friction in the pivot of the pendulum decreases the amplitudes of its oscillations:

*Physics 5: Pendulums* – Students are introduced to pendulums and their periodic motion. They design and execute an experiment to determine whether bob mass, chain length, or displacement angle affects the period of a pendulum.

For other module sequences and groups, look here: [www.sciencefromscientists.org/sequences](http://www.sciencefromscientists.org/sequences)

## Standards Covered:

Please click the following link to our website to review the standards covered by this lesson, listed by state: [www.sciencefromscientists.org/standards/](http://www.sciencefromscientists.org/standards/)

Lessons are matched to both national NGSS and local state standards.

## After Our Visit:

*Extend this lesson by interleaving the pages of two phonebooks, to investigate the effect of adding frictional forces together.*

Access this Extension activity by visiting the Classroom Post found on our website at [sciencefromscientists.org/cohorts](http://sciencefromscientists.org/cohorts). Use the name of your school/cohort and password to log in.

To help Evaluate, check out our Open Response questions online at [sciencefromscientists.org/open-response-questions](http://sciencefromscientists.org/open-response-questions). They are freely available for all of our lessons for current teachers. Use the password supplied by your instructor to log in.

## Additional Resources:

Videos (they needed *two*) of the Mythbusters trying out the Extension activity are impressive and entertaining:

- [https://www.youtube.com/watch?v=AX\\_ICOjLCTo](https://www.youtube.com/watch?v=AX_ICOjLCTo)
- [https://www.youtube.com/watch?v=QMW\\_uYWwHWQ](https://www.youtube.com/watch?v=QMW_uYWwHWQ)

More simple friction activities:

- Demonstrating friction with rice: <https://www.youtube.com/watch?v=vn9fKJc1jkE>
- For younger students, this activity uses friction to make a slider toy work. <http://www-tc.pbskids.org/designsquadd/pdf/parentseducators/treasuregrab-english.pdf>

More about friction:

- There are more types of friction than we discussed in class. This video discusses rolling friction and fluid friction (as well as static and kinetic, also known as “sliding”, friction) in the context of riding a bicycle: <http://mass.pbslearningmedia.org/resource/6420f24e-fb83-4092-9317-4de6605cdf1c/understanding-four-types-of-friction/>
- Surprise! Fingerprints are *not* adaptations for enhancing our grip through friction: <http://jeb.biologists.org/content/212/13/i.1>

