

# Frictional Force

Teach 1	Names of student(s) teaching:
Teach date: Teach time: Teach length: 45 minutes	Title of lesson: Frictional Force in Hockey Source (Kit, Lesson, Page #):

Concept statement/Main idea:
After learning about the concept of transfer of energy, specifically the loss of kinetic energy to friction, students get a chance to test friction. Student groups are each given a wooden block and different fabrics and weights and challenged to design the "best" puck.

Standards for the lesson:
Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

Objectives	Evaluation
Write objectives in SWBAT form	Write at least one question to match the objective you listed or describe what you will look at to be sure that students can do this.
SWBAT <b>identify</b> the frictional force and how it acts to slow an object in motion.	1) Friction affects motion by: <ul style="list-style-type: none"> <li>A) increasing the speed of an object along its path</li> <li>B) decreasing the speed of an object along its path</li> <li>C) decreasing the speed of an object along its path then increasing it</li> <li>D) increasing the speed of an object then</li> </ul>
SWBAT <b>explain</b> that friction slows down motion, because of the transfer from kinetic energy to heat energy.	2) Why is it important for engineers to take friction into consideration when designing sports equipment?

SWBAT <b>explain</b> why an engineer must understand friction when designing a hockey puck.	
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## Engagement

Estimated time: 6 minutes

Description of activity: The teacher will show students a video of friction and how it affects the Winter Olympic Sport, Curling. Note: **STOP the video at 3 minutes**

[Video link](#)

What the teacher does	What the student does	Possible questions to ask students — think like a student and consider possible student responses
The teacher will show a video about friction in sports to students and will ask questions.	The students will watch the video and will answer questions	Does friction help in curling?  How would friction affect other sports such as hockey?  What kind of energy is generated after the sweeping motion is conducted?

### Resources needed:

Projector and powerpoint

### Safety considerations:

## Exploration

Estimated time: 15 minutes

Description of activity: Students will make their own hockey puck using supplies that are provided. Students will see how the different materials affect friction.

What the teacher does	What the student does	Possible questions to ask students — think like a student

		and consider possible student responses
<p>The teacher will have the students work in teams to construct a hockey puck using the different materials that are provided.</p> <p>The teacher will also walk around and ask questions about the students' design.</p>	<p>The students will work together in teams to design and make a hockey puck that can go across a surface of 10 feet.</p>	<p>What kind of materials will you be using?</p> <p>How far do you think your hockey puck will go with _____ material on it?</p> <p>Do you think the weight will play a factor in how far the hockey puck will go?</p> <p>How will the weight play a factor in how far the material will go?</p>

**Resources needed per group:**

- 1 container
- Reusable plastic containers
- 5, 100-gram weights (those that are typically used with science balances found in the classroom)
- Fabric of different materials (i.e. wool, silk, flannel, jersey t-shirt material, etc)
- Duct tape
- Meter sticks

**Safety considerations:**

Do not drop the weights on hands

[https://www.teachengineering.org/activities/view/duk\\_hockey\\_music\\_act](https://www.teachengineering.org/activities/view/duk_hockey_music_act)

[Explore Worksheet](#)

**Explanation**

Estimated time: 10 minutes

Description of activity: Students will explain their design plan and will explain what worked and what did not work when constructing their hockey puck.

What the teacher does	What the student does	Possible questions to ask students — think like a student and consider possible student responses
The teacher will have students explain the idea behind their hockey puck and will ask questions regarding what worked and what did not work in their design.	The students will present their hockey pucks and their results after it is slid across a smooth surface of about 10 feet.	<p>What material worked well with your hockey puck?</p> <p>What additional materials could help your hockey puck glide further?</p> <p>How did friction affect how far your hockey puck glided?</p>

**Resources needed:**

Hockey pucks

Powerpoint

**Safety considerations:****Elaboration**

Estimated time: 10 minutes

Description of activity: Students will connect their designs to actual designs of hockey pucks. Students will consider what factors engineers must take into consideration when making sports equipment.

What the teacher does	What the student does	Possible questions to ask students — think like a student and consider possible student responses
<p>The teacher will ask questions and have students connect their hockey puck designs to those of actual design in real-life.</p> <p>The teacher will ask how friction affects how things are constructed.</p>	The students will answer questions and will have a discussion about sports equipment and friction.	<p>Why do you think engineers have to take friction into consideration when constructing sports equipment?</p> <p>Would sports equipment work just as fine if friction were not considered?</p>

		What other things besides friction do engineers have to make when constructing sports equipment?
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**Resources needed:**

Their hockey pucks, if they want to refer to them, while explaining their answers to the questions.

**Safety considerations:****Evaluation**

Estimated time: 5 minutes

Description of activity: Students will complete the evaluation quiz on their own and turn it in once it is completed.

What the teacher does	What the student does	Possible questions to ask students — think like a student and consider possible student responses
The teacher will distribute the evaluation and pick up the evaluations once they are completed.	The students will complete the evaluation quiz on their own and turn it in when they are finished.	

**Resources needed:**

[Evaluation Quiz](#)

**KEY**

**Safety considerations:**

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Puck vs Friction

**Instructions:** You and your team will construct a hockey puck using the provided materials by your teacher. Your goal is to create a puck that will glide smoothly on a flat surface. Before you begin constructing your puck, list the items below that you will be using for your hockey puck.

**Items that will be used:**

**Why will your team be using the items listed above?**

**How well did your hockey puck glide across the surface?**

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Engineering in Sports Quiz

**1) Friction affects motion by:**

- A) increasing the speed of an object along its path
- B) decreasing the speed of an object along its path
- C) decreasing the speed of an object along its path then increasing it
- D) increasing the speed of an object then gradually helping it decrease

**2) Why is it important for engineers to take friction into consideration when designing sports equipment?**

**3) List the materials that worked well for your design and explain why the design worked well.**

