

GRIP AND SLIDE

What role does friction play on the court?

From staying put to running past the defense, we use friction a lot. Let's investigate friction, and how it can give us a scientific advantage on the court!

HERE'S WHAT YOU'LL NEED:

- Block of wood
- Aluminum foil
- Spray Bottle of Water
- Cooking Spray
- Corn Starch
- Tape
- Meter stick
- Measuring tape
- Magic Marker
- Stopwatch
- Pencil
- Notebook
- Wood or thick cardboard panel that is greater than 75 centimeters in length and as wide as the block of wood



**SCIENCE
MUSEUM!**
O K L A H O M A

WARMUPS

Have you ever slid across a tile floor while wearing socks? Would it work across a carpeted floor? Sometimes we slide. Sometimes we don't. This has a lot to do with surfaces, mass, and gravity, but ultimately it has to do with friction. Let's explore how we can use friction to help us on the court! The long wood or thick cardboard panel will serve as our testing ramp. Tightly wrap the ramp and the block with aluminum foil. Make the foil as flat as possible, rubbing out all wrinkles. You may want to tape the foil on the underside of the ramp and top of block.

Place the block of wood on one end of the ramp, use the marker to draw a line at this length. Label this line as the **starting line**. Measure 50 centimeters from the start line and mark a **finish line** across the board. There should be enough room for the block to slide past the line and remain on the ramp.

Part One:

Using the meter stick as a guide, hold the starting end of the ramp at 10 cm above the ground. This creates an **inclined plane** to slide objects down.

Place the block of wood on the ramp right behind the starting line.

Moving in 1 cm increments, **find the height of the ramp needed for the block of wood to slide down the board without being pushed**. Each time you move the ramp higher, you are increasing the ramp incline, or steepness.

Once you have found the proper height for the block to move without pushing, fix the ramp at that position. Draw a diagram in your notebook representing your setup. Label each part and the height of the ramp.

Part Two:

Hold the block of wood on the ramp again at the starting line. This time, **when the front of the block crosses the starting line, begin the timer on the stopwatch. Stop the time as soon as the front of the block crosses the finish line**. Record this measurement as Time 1 in your notebook and repeat the procedure at least two more times. Scientists use multiple data points to ensure accuracy of their tests. Record all three times.

Find the average travel time for the block with this formula:

$$\text{Average Travel Time} = \frac{\text{Time 1} + \text{Time 2} + \text{Time 3}}{3}$$

Using all of your recorded and computed data, create a table to help you share your results. It should represent the type of surface (foil), the three times measured, the average travel time.



GAME TIME

Friction is a force between two surfaces as they move or try to move across each other. Depending on the surfaces, it can make moving really hard or really easy. Think about walking on a dirt path versus walking on an icy sidewalk.

There are several types of friction. When an object is resting on a surface and you are trying to get it moving, you have to overcome **static** (stationary) friction to get going. When an object is already moving across a surface, it is overcoming a type of **kinetic** (moving) friction.

Let's explore how different surfaces impact friction. For each of the following trials, we will change the surface the block moves on. Remember to replace the foil on the block and the ramp each time you change test surfaces.

For each different surface:

- Keep the height the same as the warm-up trials
- Record the time it takes for the wood block to travel 50 cm
- Repeat the tests to get at least three data points and calculate the average time.
- Expand on your previously created table to share your data for the new surfaces.

Complete your tests wiping the block clean between each test.

Water Surface: Spray water on the foil covered surface of the inclined plane.

Cornstarch Surface: Dust the surface with a thin layer of corn starch.

Cooking Spray Surface: Generously apply cooking spray to the foil covered ramp.

Your chart may look similar to this:

Surface	Time 1	Time 2	Time 3	Average Time (sec)
Aluminum Foil				
Water				
Cornstarch				
Cooking Spray				



ANALYZE THE REPLAY

What happened?

Review all of the information you have collected through your trials and observations.

- Reviewing the chart, on which surface did the block travel fastest? Which one was slowest? Give your best explanation for these results.
- Did change in friction result in change of path for the sliding block?
- Do you think if you used a waxed wood surface instead of an aluminum foil surface there would be different resulting speeds? Use the evidence found in your data to support your answer.

Friction allows basketball players to run, turn sharply, stop quickly, dribble, and even shoot.

Basketball shoes are especially important. Shoes with good soles allow the player to use more friction by getting a better grip on the basketball court. Sweat on the court or dust on shoes leads to a weakened grip and less friction. This can cause players to slip and collide with each other.

If the block of wood represented a basketball player's shoe, which of the tested surfaces would be the best to play on?

Investigate other factors that may result in changes in friction and speed.

Using the same ramp, change the surface or the object that slides down the ramp. Remember to record your results!

OVERTIME

Let's take it further

Possible variables to try:

- Wax paper
- Sandpaper
- Coin
- Plastic block
- Modeling clay formed block
- A block made of several elements



COACH'S CORNER

Additional information and explanations for parents and educators

Friction is necessary for players to get a good grip on the floors, so basketball shoes are specifically designed to promote friction between the player and court.

Tribologists are scientists who study friction. The word tribology comes from the Greek root word "*tribo*" meaning "rubbing" and "*logia*" meaning "knowledge of."

Studying friction is important for more than basketball. It results in tires that grip the road's surface when conditions are wet and oily. Friction is what makes brake pads work for more efficient stopping. Can you think of other ways friction helps you?

DO YOU WANT TO LEARN MORE?

Research: Traction, Lubricant, Inertia, Momentum

OKLAHOMA ACADEMIC STANDARDS

STANDARD	4 th Grade	5 th Grade
Mathematics		
N 1.4 - Numbers and Operations	●	●
N 2.2 - Numbers and Operations		●
N 2.6 - Numbers and Operations	●	●
A 1.1 - Algebraic Reasoning and Algebra		●
GM 2.4 - Geometry and Measurements	●	
GM 2.5 - Geometry and Measurements	●	
GM 3.1 - Geometry and Measurements	●	
GM 3.2 - Geometry and Measurements		●
D 1.1 - Data Analysis		●
D 1.2 - Data Analysis	●	●
Science		
PS 3.2 - Energy	●	
PS 3.3 - Energy	●	
PS 2.1 - Motion and Stability		●