

THE ENERGY OF THE STORM CHASERS

Rumble has a lot of help keeping the crowd amped up before the game and during breaks in the action. The Thunder Drummers and Thunder Girls keep the crowd on their feet and the Storm Chasers have a way of getting the crowd really excited — the 3-person t-shirt launching slingshot! The thought of t-shirts being launched into the crowd toward the outstretched hands of eager fans gets hearts pounding just like an amazing dunk by the Thunder over the opposition. Though you may not be able to make a slingshot that big, you can make a handheld version and perform some experiments to see how trajectories and energy can help you launch a shirt to the right section of fans, make a successful launch, and even sink a distant shot.

HERE'S WHAT YOU'LL NEED:

- Toilet paper tubes
- Rubber bands
- Pencils
- Scissors
- Masking tape
- Ruler
- Tiny pompoms
- Small rubber bouncy balls
- Journal
- Safety goggles or other eye protection

WARMUPS

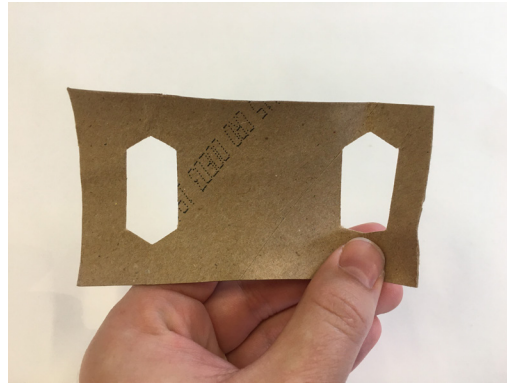
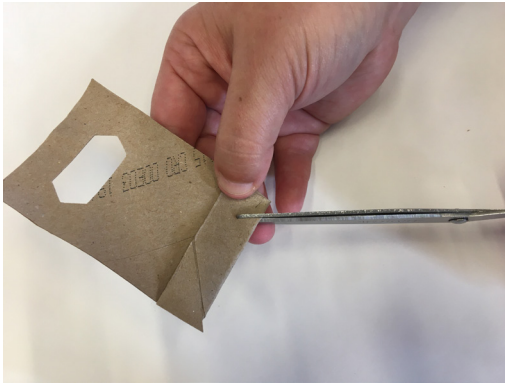
To begin, you'll need to take one toilet paper roll and cut it in half lengthwise. (You want to make it look like a hot dog bun, not a hamburger bun.) Once you've sliced the roll open, you're going to want to roll it closed tightly. Wrap masking tape around all of it to keep it closed, but be sure to leave about one inch without tape at one of the ends.



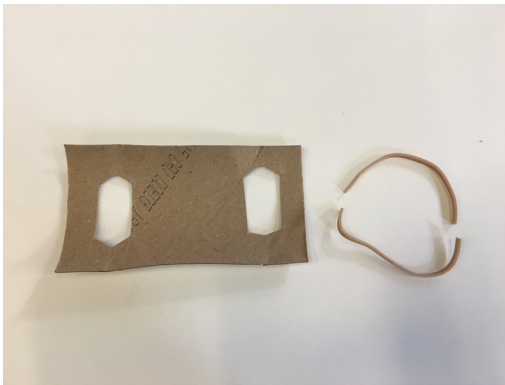
Next, use a hole punch or scissors and poke two holes on the end of the rolled tube without tape. These holes should be just big enough for a pencil to go through. These holes should be directly across from one another, not on different ends of the tube. After you've made the holes, slide a pencil through them, and set this piece off to the side. This will be the handle for your slingshot.



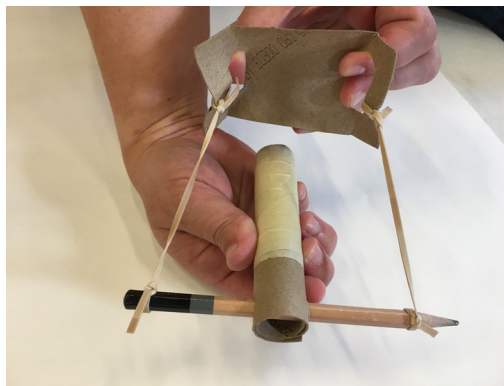
Take another toilet paper roll, and after cutting it open like your first one, cut a strip from it that's about 2 inches by 5 inches (or roughly that same size—it doesn't have to be precise!) Folding the end down, use scissors to cut out a slit on each of the short ends. This piece of cardboard is going to be your pouch for your slingshot.



Cut two rubber bands in half so that they are just long rubber strings. Thread one piece through one of the slits on your slingshot and tie it in a knot to secure it. Repeat this with the other piece of rubber band and the other slit.



For the last step, take the two loose ends of the rubber band pieces and tie one on either end of the pencil that's in your handle.



You've built your slingshot! Now it's time to put it to the test!

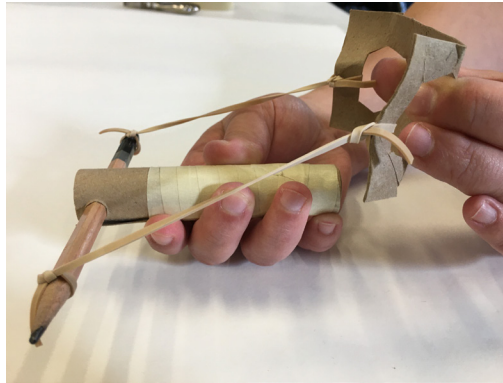


GAME TIME

At Thunder games, the Storm Chasers skillfully maneuver their giant slingshot and aim it high and low to launch t-shirts into all the different sections of the Chesapeake Energy Arena. You're going to conduct some tests with your slingshot to see if you can collect data about energy. To perform these tests, you're going to work with a partner. You'll also need a small pompom, rubber bouncy ball, your slingshot, your journal and something to write with. Your partner will record the data for your test shots, and then you will do the same for them!

Hold your slingshot so that the handle is flat in your hand and parallel with the floor (as opposed to holding the handle upright pointing towards the sky, like you might traditionally hold a slingshot).

PRO TIP: Always wear goggles or eye protection when launching projectiles.



Try shooting a pompom a couple times holding the slingshot like this to get the hang of it.

The trajectory is the path an object makes through the air during its launch until it hits the ground. Depending on a lot of different factors, trajectories can be really big arcs — almost like a steep drop on a roller coaster — or they can be gentle arcs — more like a low bridge over a creek.

For this first test, you're going to shoot the pompom repeatedly and only change up one variable—how far you stretch the sling and rubber bands. Begin by launching the pompom and only stretch the sling back about two inches from where it is when it's loose. How far did the pompom go? What kind of trajectory did the pompom have?

Have your partner record this data in a journal. Now try launching the pompom and stretch the rubber bands about six inches. Record the data from this test, too. Lastly, launch the pompom and stretch the rubber bands as far as they will go. (Be careful not to crumple the handle of your slingshot with all that extra pressure! It is just cardboard after all and can only support so much.)

After you've completed three separate tests with the pompom by pulling the rubber band back three specific amounts, repeat this test with the bouncy rubber ball. How (if any) did the weight difference of the bouncy ball compared to the pompom affect the results of the launches? How did the weight difference affect the trajectories? How did the weight difference impact the effort you had to put into launching it? Write the answers to these questions in your journal, along with the data of how far the rubber ball went in each launch and what the trajectory was like.

Now that you've completed multiple tests of launching both the pompom and the rubber ball, it's your partner's time to test their own slingshot. Record the results of their tests in their journal. How do their results compare to your own? Work with your partner to compile all of the data into a chart.



**ANALYZE
THE REPLAY**
What
happened?

How did your results from these tests compare to all of your classmates' results? If there was wide variance throughout everyone's results, what do you think might have contributed to that? What different data do you think you would collect if you increased the variety and diversity of projectiles? What if you factored in trying to aim your projectile to a variety of different spots? What steps might you need to take to gain consistency in your launches?

Storm Chasers only use their massive slingshot to launch t-shirts, so the size and weight of their projectile is always going to be the same. However, they have to consider how they're going to consistently land the t-shirt into the hands of fans throughout all the different seating sections—even way up in Loud City! Plus, they have to work with two of their colleagues to hold and shoot the slingshot. Given that they have to get the t-shirt through such a long distance (and based on what you've observed about trajectories) how do you think they

would need to aim their slingshot? Would they need to aim higher than their intended target, lower than, or directly at it? How would the amount of energy they put into stretching the slingshot affect where the t-shirt lands?



OVERTIME

Let's take it further

The slingshot that you built out of toilet paper rolls is only one style of slingshot out of dozens of different designs. What other materials could you repurpose into a slingshot? Do you think you could engineer a giant one that would take the help of your friends to launch?

Additionally, how much more could you learn about trajectories from launching things with your cardboard slingshot? You only briefly examined them in this activity, but by taking into consideration aiming when you launch your projectile, you could experiment with many different trajectories that an object in motion could take. Trajectories are not only important to the Storm Chasers when they're launching t-shirts—the trajectory of the basketball determines if it swooshes through the net or clangs off the backboard! Additionally, the trajectory of an across-the-court pass can be the difference between the ball reaching the intended player and sailing into the crowd.

PRO TIP: If time and space allow, form into small groups and design a larger slingshot with materials that may be readily available. Go to a large area like the gym, lunchroom, or playground, and then create a challenge to compete in as teams. The challenge could be something like, "Launch a plush animal from one side of the gym/lunchroom/playground to the other." The team that launches and lands the item closest to the designated area most consistently is the winner—and maybe have a future as Storm Chasers!



COACH'S CORNER

Additional information and explanations for parents and educators

This slingshot activity dealt with two different principles—the storage and transfer of energy as well as trajectories. The **work** that the students exert on the rubber band to pull it back is transformed into potential energy that is stored in the slingshot for as long as they keep the rubber band stretched. When they release it, the energy is transferred to the projectile and becomes kinetic energy. Using these principles of physics, the Storm Chasers at a Thunder game are able to use a giant slingshot to launch t-shirts into the audience with much more strength than one person could throw.

In scientific terms, work refers to using a force to move an object a distance

This potential and kinetic energy can also be seen in Thunder players' muscles. Muscles can act like springs that store potential energy until that energy is needed and the muscle can apply a force turning it into kinetic energy. Just as the slingshot rubber band needs to be pulled back to differing degrees to properly launch the projectile, so a Thunder player uses different muscles in his arm to make a last second shot from halfway across the court as opposed to shooting up close to the rim.

Additionally, trajectories were demonstrated by the projectiles released from the slingshots. Trajectories are important to consider when launching something from a slingshot (whether it's a pompom or a t-shirt) because you must keep in mind how the object is going to move through the air in order to be able to accurately predict where it will land. This is why Storm Chasers will often launch the t-shirts much higher than it might seem necessary; by giving the t-shirt a larger trajectory it allows for it to cover more space in the arena as well as land more gently among fans. If the Storm Chasers were to aim directly at a fan and launch the t-shirt, the kinetic energy in the shirt might be enough to hurt the fan!

DO YOU WANT TO LEARN MORE?

Research: Applied Force, Energy, Gravity, Kinetic Energy, Potential, Trajectory, Work

OKLAHOMA ACADEMIC STANDARDS: MATHEMATICS

STANDARD	4 th Grade	5 th Grade	6 th Grade
Science			
PS2-1 Motion and Stability		●	
PS3-1 Energy	●		
PS3-4 Energy	●		
MS-PS2-5 Motion and Stability			●
MS-PS3-1 Energy			●