Rumble Zips In

Engineer the perfect way for Rumble to make his grand entrance!

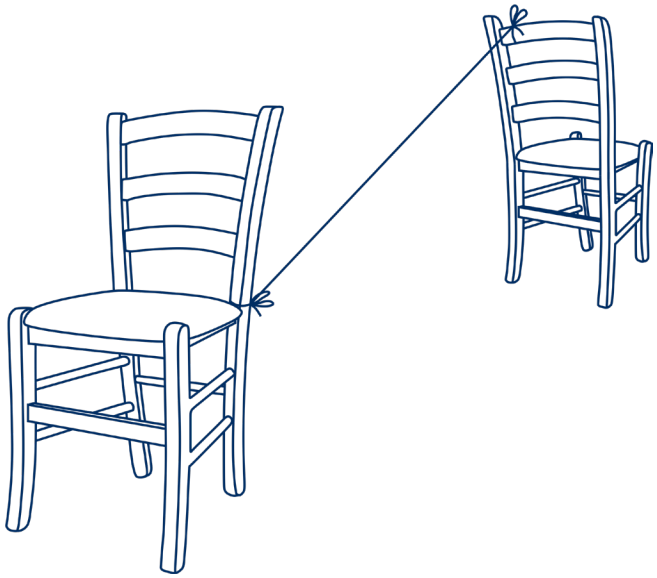
Rumble the Bison definitely loves to make a spectacular entrance at the beginning of each home Thunder game! From bringing the lightning with a Tesla coil to amping everyone up with his drum, he has a spectacular talent for increasing the excitement anytime he's around. See if you can engineer an extra-outrageous way for him to make it to center court — on a zip line!

HERE'S WHAT YOU'LL NEED:

- **Kite string or fishing line** *(just make sure it's smooth — Rumble doesn't want a bumpy ride!)*
- **Index cards, cardstock, cardboard, or paper**
- **Masking tape**
- **Paper clips**
- **Plastic straws**
- **Assorted cups** *(portion cups, paper cups, and plastic cups of varying sizes all work great)*
- **Scissors**
- **Rubber bands**
- **Assorted building materials** *(pipe cleaners, craft sticks, balloons, etc.)*
- **Marbles or washers for weight**
- **Basketball court target printout** *(included)*
- **Rumble printout** *(included)*
- **Journal or notebook and pencil**

WARMUPS

Begin by assembling your zip line and making sure it's ready for your testing. Stretch a length of string or fishing line as tight as you can between two chairs, two desk legs, or whatever furniture you have on hand. You will need to create a sloped path (as you are going to let gravity do all the work of taking Rumble down the line) by tying the "start" end higher than the "finish" end. Test to make sure the angle is steep enough by hooking a paper clip to the start of the zip line and letting it go. Does the paper clip make it all the way to the bottom? Rad! It's steep enough! If the paper clip gets stalled out or stuck, though, tinker with your zip line to see how you could increase the steepness of the slope. Once you've gotten the angle where you want it, place your basketball court target printout directly underneath the zip line towards the middle — this will come in to play with your next challenge!



PRO TIP: If space and resources allow, try to make several zip lines throughout the classroom so that multiple people can test at the same time!

Next you're going to try sending Rumble down the zip line in a safety trial. (After all, he definitely practices all his stunts and acrobatics before the performance at the big game rolls around!) You will need to design a carrier of some sort to hold Rumble as he rides down the zip line. Start by sketching some ideas in your journal, and then pick the idea you think will work best. Next, label the parts of your carrier in your design, and write a materials list of the things you'll use to build it. Then, you get to start bringing your creation to life! The only requirements are that your carrier and Rumble have to make it to the end of the zip line, and he has to be able to sit or stay in your carrier by himself — Rumble doesn't want to get smothered by a bunch of masking tape holding him in the carrier, so try to fashion a seat belt or harness for him if need be!

Once you've built the carrier and have Rumble comfortably situated in it, attach it to your zip line. **(Some possible items with which to attach it include a paper clip, straw, pipe cleaner, or anything else you think will allow your contraption to smoothly fly down the line.)** Conduct a few tests of your carrier to see if it behaves consistently time after time. Are there any changes you could make to your carrier to improve it? Write down any ideas you have for improvements or changes in your journal.

GAME TIME

Now that you've successfully run safety trials of Rumble going down the zip line, it's time to engineer his big game-starting entrance. For this you're going to need to build a second carrier in which Rumble can ride down the zip line along with a way to release him from the carrier at the exact right moment so that he'll dramatically and triumphantly land in the center of the court on the OKC Thunder logo. As teamwork and sharing ideas are also super important in engineering, you'll work with a friend for this part of the challenge. Think about the device you built in the Warm Up exercise. What were some of the components of your carrier you built in the first challenge that might work well in this one? How about your partner's carrier? After discussing your ideas, sketch your new design and write down your ideas in your journal. Using the experiences you both had in the first challenge could prove to be helpful in this one!

Make sure to discuss how you're going to create a release mechanism for your carrier, as well. **Are you going to use something to tip or turn your carrier over as it's going down the zip line? Will Rumble ride somewhere on the outside of your carrier and you'll create a way for him to drop off the carrier? Will you use weights on either your carrier or Rumble himself to make him heavier and likely to drop more quickly?** Since you're working with a partner, you can get even bigger and bolder than you could working by yourself — you've got two sets of hands now, obviously! Maybe one of you can be in charge of setting the carrier down the zip line and the other one can be in charge of activating the release mechanism.

Begin construction with your partner on your collaborative carrier. Feel free to test on the zip line as much as you need while you're working through the building process, and continue tweaking and working to improve your carrier with your teammate.

ANALYZE THE REPLAY

What happened?

What happened if Rumble was released directly above the OKC Thunder logo on the target basketball court? How challenging was it to make Rumble release at the exact spot you needed him to land? What method did you end up using to successfully release him from your carrier? What other factors impacted the successful delivery of Rumble onto the court that you didn't expect?

After you, your teammate, and all of your classmates have finished creating and testing your Rumble carriers, share your ideas with your class about what worked and what didn't. Explain the process behind your design as well as any problems you ran into throughout the engineering process, and allow all of your classmates the time and opportunity to explain their own creations, too.

OVERTIME
Let's take it further

Can't get enough of zip lines? Try taking it up a notch by engineering a way for Rumble to ride down the zip line and drop at the exact moment — but without a carrier in which he can ride! This means you have to figure out a way to attach him directly to the zip line but also a way for him to detach from the line to drop onto the court.

COACH'S CORNER
Additional information and explanations for parents and educators

There are several different concepts that students tackled in these challenges. First, they explored hands-on and real world examples of **Newton's First Law —** "Every object persists in its state of rest or uniform motion in a straight line unless it is compelled to change that state by forces impressed on it." This is the main principle of how zip lines work; as Rumble (in his carrier) traveled down the zip line, he built up forward speed. He kept going at this speed until a force acted upon him (namely, hitting the bottom of the zip line).

Additionally, students experienced **acceleration** both in the way the carrier gained speed as it went down the zip line and in the way Rumble's speed increased as he fell. One of the biggest challenges students likely faced was due to Rumble's **trajectory** as he was released from his carrier. Because he was already moving horizontally down the zip line, when he was dropped, he traveled in a curved path, called a trajectory. This principle means that the students needed to learn that Rumble should be released from his zip line carrier before he reached the OKC Thunder logo on the center of the basketball court.

Lastly, students got an in-depth experience with the engineering design process. They were given a problem (or challenge, rather), asked to sketch and write down their ideas, build and create their design, test it, rework it to make it better, test it again, and continue reworking and testing until they ran out of time. These are the crucial parts of the engineering design process. Working in this way is not a linear process, but rather a circular path that allows for many successes and failures time and time again, with lots of opportunities to both celebrate and learn. Giving the students the opportunity to present and talk about their carrier and results at the end of the activity is another important part of this creation process. It allows them to both be proud and highlight their successes in front of their peers, as well as learn from the different and unique ways their fellow students thought to solve the problem. It also allows all the students to be more comfortable with failure and mistakes and see them less as something to be avoided and more as just another step in the design process and something that can give valuable lessons.

DO YOU WANT TO LEARN MORE?

Research: Applied Force, Kinetic Energy, Newton's Laws, Momentum, Potential Energy, Trajectory, Variables

OKLAHOMA SCIENCE STANDARDS

STANDARD	3RD GRADE	4TH GRADE	5th Grade
PS 2-1 - Motion and Stability	●		●
PS 2-2 - Motion and Stability	●		
PS3-1 - Energy		●	
PS3-3 - Energy		●	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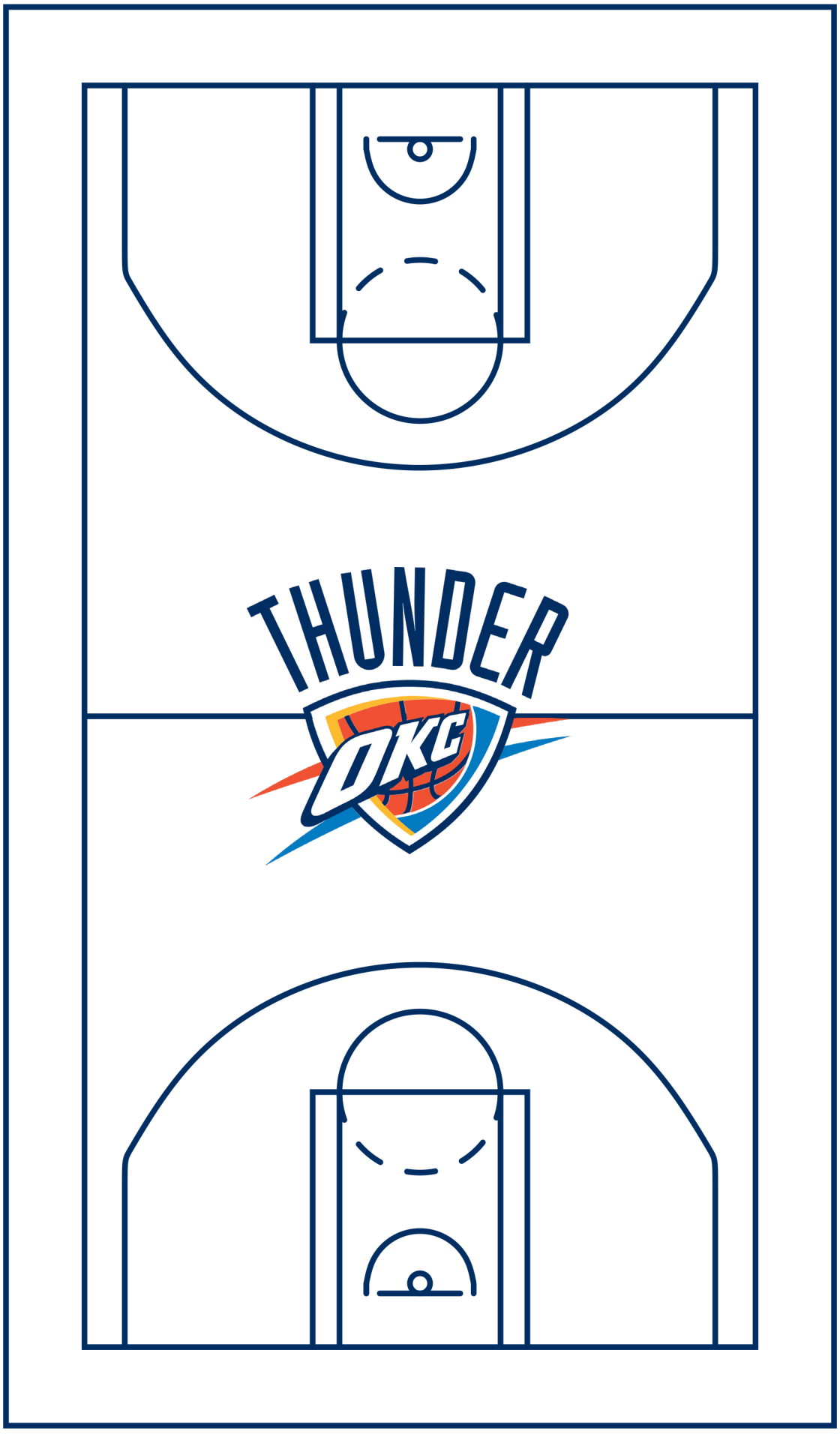
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