Amusement Park Extravaganza!

Grade: 5-6

Time: 2 hrs

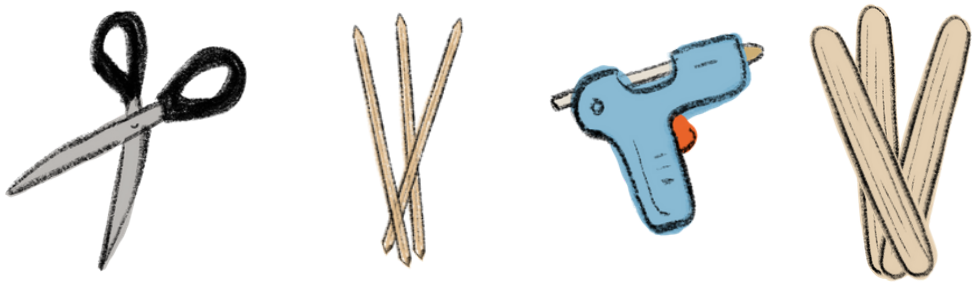
Activity Overview :

Did someone say, "Amusement Park"? In today's activity we will be exploring physics concepts that engineers use in order to create mechanical systems. You have been recruited as the lead mechanical engineer on this project: you must design and build safe, and fun rides! We will design and build our very own Ferris Wheel to begin, but every amusement park needs more than one ride; next, you will create your very own ride! Before we begin, think about the following questions:

- What makes a strong structure?
- What is the role of stability in mechanical systems?
- How can we know our Ferris Wheel is safe for riders? What makes a ride safe?

Materials:

- Popsicle sticks
- Hot glue gun
- A skewer or smooth stick

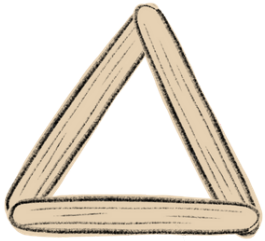


Don't worry if you don't have all these supplies. Experiment with other everyday items and see what you can build!

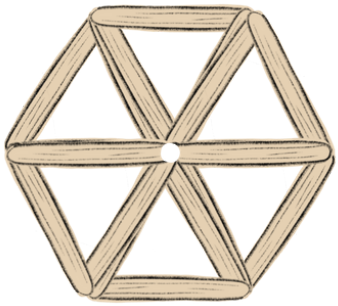
Activity:

1. Begin by creating a triangle using 3 of the popsicle sticks and gluing them in place.
2. Continue to create 5 more triangles exactly like the first one, until you have a total of 6 triangles.
3. Once you have all the triangles, try putting them together to make a hexagon (6 sides). There should be a small circle in the middle where the popsicle sticks connect. Once you have the hexagon shape, you can hot glue them together.

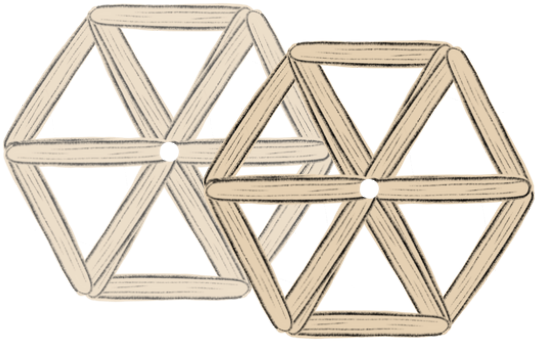
Step 1



Step 2

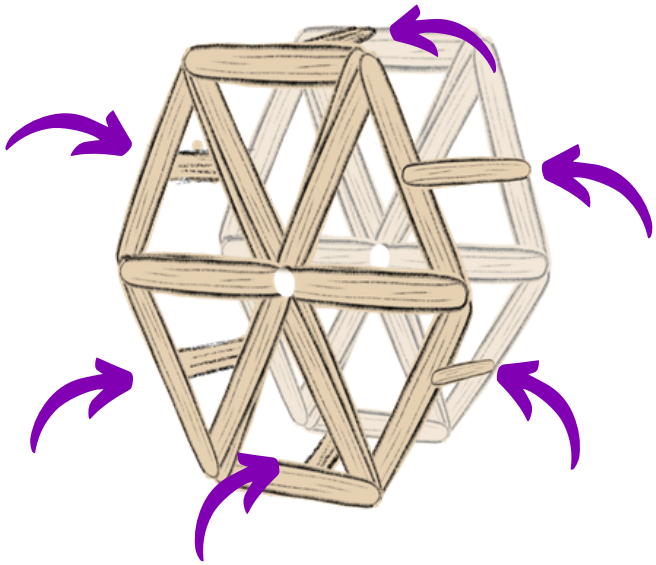


Step 3



4. Next, we're going to join our two hexagons together! Match up the hexagons so that they are facing each other, this step is very important as it will determine how well the wheel will spin, so ensure the wheels are lined up accurately.
5. Take a few popsicle sticks and break them in half. Glue one popsicle stick to each side of the hexagons, joining the two shapes together. This step requires 6 popsicle sticks in total. You now have a ferris wheel!

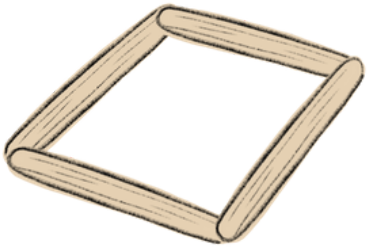
Step 5



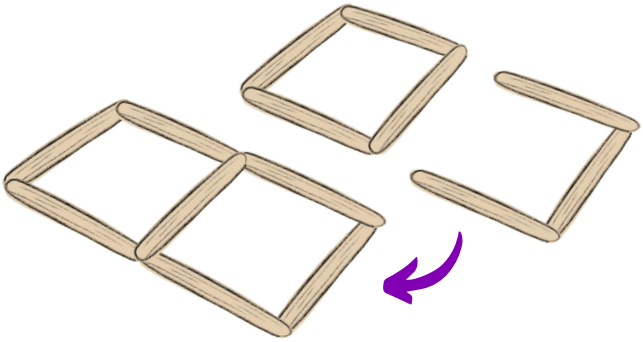
6 Let's start working on your ferris wheel base. Take four popsicle sticks and create a square.

7 Build a U shape with 3 popsicle sticks and then glue it to your popsicle square. You will now have a rectangle base.

Step 6



Step 7

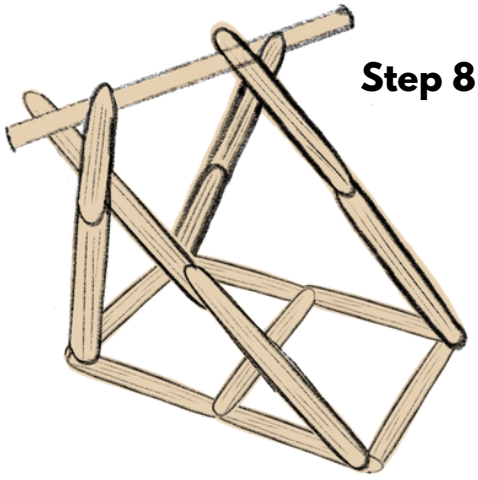


8 Now we need to create two large triangles place on each of the long ends of our rectangle base. To do this, take 2 popsicle sticks and place one slightly overtop of the other one and glue it in place. Do this to another 2 popsicle sticks, so that you have two elongated sticks.

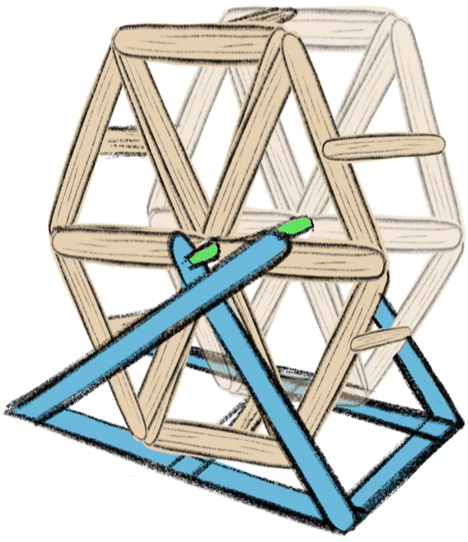
9 Take these two long sticks and glue each one in a separate corner of your rectangle base on the same side. You want to make sure that the top (point where the two popsicle sticks touch each other) crosses over a little bit so that your ferris wheel axel can sit on top. Do the same thing to the other side so that you have a triangle on each side of your rectangle base.

10 Let's put our ferris wheel together! Grab a skewer and place it through the middle of your ferris wheel. Then, rest the ends of the skewer on the triangles we just created that are attached to the rectangular base. Make sure to test your wheel and see if it spins nicely!

Step 8 & 9



Step 10



Engineering and Science Connections

Physics is the study of matter and its motion, along with how it interacts with energy and forces in the physical universe. Physicists explore the principles of structures, behaviour of matter and their interaction with energy.

Mechanical Systems are machines or devices that use power to apply forces and control movement. Mechanical engineers use math, physics, and material science to design and create these systems.

Stability refers to a structure's ability to resist a change in balance. A stable structure would not be prone to fluctuation.

Our Amusement Park project has helped us identify the role of physics and mechanical systems in our everyday lives; we see how science and engineering creates fun! Now that we understand the importance of careful planning and problem solving, we can answer these questions:

- What makes a strong structure?
- What is the role of stability in mechanical systems?
- How can we know our Ferris Wheel is safe for riders? What makes a ride safe?

What makes a strong structure?

A structure depends on shape and materials for strength. Geometry is very important as it determines a structure's ability to withstand forces that could break it or alter its shape. A structure's strength is complimented with the use of strong materials, which is why rides like rollercoasters are made from metals like steel!

What is the role of stability in mechanical systems?

Stability keeps a system balanced. In science, we say a system is balanced when there is a controlled output; the system exerts the same amount of force that acts on it. Stability is a very important structural aspect to achieve so that things like weight do not affect the way a structure stands.

How can we know our Ferris Wheel is safe for riders? What makes a ride safe?

A safety feature that makes all moving systems safer are seatbelts! As we've seen at amusement parks, the rides always have some sort of seatbelt or bar to keep you in your seat! Materials also make a ride safe, specific material, like rigid metal. Another safety feature that isn't necessarily physical, would be rider conduct! How can we ensure safety? Enforce the rules of your ride! You've built it, you know its limits better than anyone! This is why we always hear a list of rules before a ride begins, as mechanical systems do have their own limits.

Extensions:

As we've talked about earlier, structure stability is heavily reliant on balanced input and output forces. We can use our Ferris Wheel to demonstrate the effect of unbalanced forces.

Here's how:

- Begin by attaching a small mass (anything you want to test: magnets, marbles, eraser, etc) using a string to your Ferris Wheel.
- Attach the mass to one side of the Ferris Wheel and release it. Observe what happens.
- Now, attach the exact same mass on the other side of the Ferris Wheel and release. What happens? As we can see, forces play a huge role in structure stability!

You can also take a look at the ESQ at Home Activity "Simple Machines Playground" so that you can create different rides that you think will be fun for your park. Try using different materials and challenging yourself!

Share your creations!

Don't for get to share your experiments and creations with us! We would love to see what you've made. You can Email us at: esqinfo@uwaterloo.ca or send us a message/tag us on our social media!

Facebook: @uwengoutreach

Twitter: @UWEngOutreach

Instagram: @uwengoutreach

Thanks for exploring, discovering, and learning with us!

3, 2, 1 Done!

3 - Write or draw 3 things you learned from this activity

2 - Write or draw 2 things you found super interesting or cool and want to learn more about

1 - Do you have any questions about the activity? Did something make you wonder...what if? how? or why?