PRESENTED BY: girlstart

deSTEMber

SCIENCE ★ TECHNOLOGY ★ ENGINEERING ★ MATH

On Target

Do you think you can create a device that carries a marble down a zip line to land on a target? In this fun challenge, learn about potential and kinetic energy and how they can help you get your marble on the target. Does the angle of the zip line affect the speed? Can you land your marble in the same place twice? Try out different designs in this hands-on experiment to create the fastest, most accurate vehicle possible.

TEKS:

6.8B Identify and describe the changes in position, direction, and speed of an object when acted upon by unbalanced forces.
6.8E Investigate how inclined planes and pulleys can be used to change the amount of force to move an object.

How To:

1. Your challenge is to create a vehicle that will carry a marble down the zip line. The marble must be able to leave the vehicle on its own in order to land on the target zone.
2. Zip line set up: tie the smooth twine between two objects (e.g. two chairs or a table and a chair). Make sure the line is taut and that one end is about 20 inches (50 cm) below the other. Then, tape the target zone beneath the end point on the lower side of the zip line.
3. First, test different options to transform the paper cup into a zip-lining vehicle. Do you need to modify the size? Or add anything to it?
4. Then, think about where the marble should ride on your vehicle: Inside? Outside? Underneath? Does something need to be added to help hold it in place? Place your marble in this location and make any adjustments as needed.

Materials:

- 1 yard of smooth twine (fishing line or kite string)
- Target zone (attached below)
- 3 paper cups
- 6 index notecards
- 15 paperclips
- 1 marble
- Masking tape
- Scissors

How To (continued):

5. Next, add a remote release. Design a method for removing (dropping) the marble from your vehicle at the perfect moment (time) to land on the target. *Will* you *dump the marble out of the cup or create a device using notecards and paperclips that knocks it off the outside of your vehicle?*
6. Then, clip the vehicle to the zip line. Figure out how to hook the cup and paperclip onto the line so that the vehicle slides down smoothly.
7. Design 2-3 different models so that you can test and see which vehicle might work the best.
8. Launch your vehicles down the zip line to see how successful each one is. If they don't work exactly as you wanted, redesign and see if you can make the vehicles work better.
9. Once you have a working vehicle, change the angle of your zip line to see if you can make the marble reach the target zone faster.

The STEM Explanation:

Both your cup and marble possess potential energy, the measure of how much possible energy an object has to do something, when you clip your vehicle onto the zip line. This means that when you let go of your cup and it begins to travel down the line, potential energy transfers into kinetic energy, the energy of an object in motion. However, the marble still has potential energy because it is not moving on its own. When you activate your release mechanism, the marble then uses kinetic energy as it moves from the cup towards the target below. When you increase the angle of the zip line, the line becomes steeper, causing the force and speed of your vehicle to increase.

Career Connection:

Aerospace engineers are responsible for the design, construction, and application of the science behind the forces and physical properties of aircrafts, rockets, and spacecraft. For any aircraft or spacecraft, an aerospace engineer must understand its aerodynamic characteristics and behaviors, airfoil, control surfaces, lift, drag, and other properties.

Resource:

- PBS Kids: http://pbskids.org/designsquad/parentseducators/resources/on_target.html


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