High Touch High Tech®

Science Experiences That Come To You

Marble Rollercoaster

Supplies:

- Foam tubular pipe insulation (1/2-in x 6-ft) or (0.75-in x 6-ft)
- Glass marbles (various sizes)
- Paper or plastic cup
- Roll of blue electrical masking tape (3/4" - 2")
  Note: The blue electrical tape will not tear the foam; it comes off cleanly. Masking tape will tear and make it more difficult to re-tape.
- Xacto knife
  Note: Requires ADULT assistance.

Optional

- Wooden marble
- Strips of velcro
- Cardboard tubes (toilet paper, paper towels)

Instructions:

Using foam insulation, some objects around the house, blue electrical tape, and some marbles, you can create a Marble Rollercoaster!

Note: Ask an adult to help you prepare the foam tubing using an xacto knife. Cut the foam insulation in half length-wise. This will provide 2 rollercoaster "chutes."

Ramp Rollercoaster

Design a rollercoaster so that a glass marble can travel down the foam tube into the paper or plastic cup.

1. Place the cup 1 foot away from the end of the tube
   - How high should you hold the tube?
   - Should you tape the tube to a chair?
   - Could you tape it to the wall?
   - Should someone hold the cup or should it be on the ground?
2. Test the glass marble
   - Does it fall into the cup?
3. Adjust the height of the tube
4. Adjust the distance of the cup from the tube
5. Test your rollercoaster with a glass and a wooden marble.
   - Which marble works the best?

- Which marble is heavier? Which is lighter?
- Why does the weight of the marble determine how fast it rolls?

6. Continue to fix the height and distance of your ramp
   - How far away can you place the cup?
   - How high is your ramp?

Loop-de-loop Rollercoaster

What makes a very exciting rollercoaster? The Loops! Try making a loop on your rollercoaster. When you are riding a rollercoaster and go through a loop, why don't you fall out of the car? Why doesn't the marble immediately fall to the ground when it goes through the foam loop? It is because of ***centripetal force.*** This is a force that moves an object towards the center of a circle. Centripetal force constantly pulls an object towards the center of the loop, such as, a rollercoaster.

1. Use the blue electrical tape
2. Make sure the ramp is high enough to create sufficient kinetic energy.
3. The marble should turn inside the loop and continue down the ramp.

Test your loop with different sized marbles:

- Which marble works the best?
- Why might the heavier marble travel faster down the hill but have trouble in the loop?
- If your marble is not completing the loop, make some changes with the coaster.
- Is the loop too big?
- Is the ramp leading in to the loop steep enough?
- Is the ramp long enough?

Improve your rollercoaster design:

- Can you make the rollercoaster longer?
- Can you make more loops?
- Add to the coaster.
- Use tape to connect another tube.
- Use velcro to attach the loops.
- Create a hill after the loop.
- Use a book to make a hill.
- Lay the tube over the book.
- Make 2 loops.
- Use the cardboard tubes as tunnels.

- What items around the room can be part of your rollercoaster?
- Which marble works best?

The Science Behind It:

Did you know you can create an Amusement Park in your living room?! The rides at amusement parks are lots of fun with fast cars, spinning carousels, towering swings, and, of course, rollercoasters! Why are these rides so much fun? Science! That's right, the Laws of Physics and Motion provide the science behind amusement park rides.

Energy is the capacity or ability to do work. **Potential energy** is stored. **Kinetic** is the energy of motion.

When you ride a bike and reach the top of the hill, that is **potential energy**. If you hold a pencil above your head, the pencil contains potential energy. If you drop this pencil, what happens? The potential energy is converted to ***kinetic energy*** as it falls to the ground.

A rollercoaster is a good example of utilizing **potential** and **kinetic** energy. As the car climbs higher and higher, the potential energy increases. To use the stored energy, the rollercoaster car must go down the hill. As the car goes down the hill, *potential energy converts to kinetic energy*.

Rollercoasters are exciting because of the continued conversion of potential energy to kinetic energy. The car goes up hills, loops around, turns upside-down, corkscrews, and rushes downward.

History of Rollercoasters

When did people start riding rollercoasters? Historians trace the first rollercoasters back to Russia in the 16th century. They designed and constructed wood-framed sleds to go down Ice Slides. They would find ice slopes reaching 70 feet high, sit on the wooden sleds, and slide down the ice. As this activity gained popularity, Russians rolled down the slopes in wooden carts during the summer. These wooden rolling carts were the first designs for rollercoaster cars!