

# Centripetal Force

**Estimated Time: 15 minutes**

## SUMMARY

Why do you seem to get pushed against the car door when you take a sharp turn? Why don't you fall out of a roller coaster when going upside down through a loop? The answer to both of these are centripetal force—a force that's all around but often not well understood!

## WHAT YOU'LL LEARN

- The difference between *centripetal* and *centrifugal* forces.

Materials Used for Each Student	Resources Used
<ul style="list-style-type: none"> <li>Clear balloon (more if possible)</li> <li>Penny</li> </ul>	<ul style="list-style-type: none"> <li>Demonstration by Steve Spangler <a href="https://www.youtube.com/watch?v=yyDRI6iQ9Fw">https://www.youtube.com/watch?v=yyDRI6iQ9Fw</a></li> <li>Centripetal vs. Centrifugal Force (for older students) <a href="https://www.youtube.com/watch?v=9s1IRJbL2Co">https://www.youtube.com/watch?v=9s1IRJbL2Co</a></li> </ul>

## WHAT TO DO

- Take your clear balloon and put the penny inside. With the coin inside, blow up the balloon to a large volume and then tie off the bottom of the balloon. You now have an inflated balloon containing the penny.
- Grip the top of the balloon with the penny resting at the bottom. Using a circular motion of your wrist, spin the balloon around so that the penny begins to roll. Try to get the penny moving along the middle of the balloon in a circular path.
- Stop rotating and watch the penny. It keeps spinning!
- The reason that the penny keeps spinning is the *centripetal* force that keeps it pushed towards the center of the balloon. Many different forces can be centripetal; in this case it's the wall of the balloon that won't let the penny pass through it. Instead, the penny rotates around in a circle as it's redirected back towards the balloon's center. It stays against the wall of the balloon because of the reactive *centrifugal* force.
- What else can fit in there? Try putting something else that can roll in the balloon like a marble, round eraser, or bead. Try something "sort of" round like a hexagonal nut, peanut, or pebble. What's the difference in their behaviors? Does everything round roll like the penny did? What makes them faster or slower?

## TIPS

- The video link at the beginning of the activity shows this demonstration in action as well as an extension with a hex nut. It also shows someone swinging cups of water up over her head and not spilling them (until the end).
- "Centripetal" literally means "center-seeking." It's a force that pushes something towards the center of its rotation. "Centrifugal" literally means "center-escaping" and it's the

reactive force opposite the centripetal forces. Just like you feel a tug left when your car turns right, the penny feels a force outward because of the force acting inward.