

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 questions is 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"> • Clear balloon (more if possible) • Penny 	<ul style="list-style-type: none"> • Demonstration by Steve Spangler https://www.youtube.com/watch?v=yyDRI6iQ9Fw • Centripetal vs. Centrifugal Force (for older students) https://www.youtube.com/watch?v=9s11RJbL2Co

WHAT TO DO

1. 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.
2. 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.
3. Stop rotating and watch the penny. It keeps spinning!
4. 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.
5. 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.