

The Power of Spin

Try this experiment to learn how gymnasts and high divers use the power of spin to make flipping and somersaulting through the air look easy.

Collect

- Sturdy plastic drinking straw
- String
- Scissors
- 2 metal washers, one larger than the other (1 1/2" diameter and 3/4" diameter work well)
- Stickers (optional)

Make your spinner

1. Cut a piece of string so that it is about 8" longer than the straw.
2. Thread the string through the straw.
3. Tie the larger washer on one end of the string, and the smaller washer on the other end of the string.
4. If you'd like, cover the holes on either side of the washers with stickers.



Give it a spin!

5. Hold the straw vertically with the smaller washer on top.
6. Reach your arm out and make rapid circles with your wrist to get the smaller washer to start spinning around the straw. Keep spinning at a consistent speed until the larger washer is touching the bottom of the straw.
7. Continue spinning, and with your other hand, slowly pull down on the larger washer.
8. Observe what happens to the spin of the smaller washer.

What's happening?

All spinning objects have angular momentum. Angular momentum depends on two things: velocity and momentum of inertia. The velocity of a spinning object is how fast the object moves in a circular motion. The moment of inertia describes the object's mass; where it's located and how it's distributed. Velocity and angular momentum always affect each other. If you alter the length of the string, you change the moment of inertia, which then changes how fast the object spins. When you pulled down on the larger washer, the string shortened and the smaller washer started spinning faster. When an object's mass is closer to the point of rotation, it has a larger moment of inertia which means the objects spins faster.

You can also demonstrate this by sitting in a spinning chair. Ask someone to spin you on a carpeted surface while you hold your arms straight out to the side. Pull your arms in to your body and notice what happens to your spin!

What's the sports connection?

When an athlete spins, you might notice that they change the shape of their body depending on how fast they need to rotate. When an athlete wants to rotate more slowly, their body is usually in a strait line. This is called the "layout position" in gymnastics and the "staight position" in diving. When the body is stretched out, the moment of inertia increases, and the athlete rotates more slowly.

When a gymnast or diver wants to rotate faster, they bend their bodies in half and pull their knees into their chest. This is called the "tuck position," which decreases the moment of inertia causing the athlete to rotate faster. Gymnasts or divers that need to spin two or three times will tuck themselves into the smallest shape possible in order to spin very fast.

