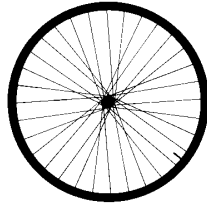


Bicycle Wheel Gyroscope



Summary: Hold and tilt a spinning bicycle wheel to experience the effects of angular momentum.

Related Exhibits: Spin Speed, Build a Top
Time: 10 minutes
Age: Third Grade through Adult
Staff: 1 staff to spin the wheel and watch for safety
Safety Issues: Watch for fingers in the spinning spokes, and don't let the spinning tire rub against bare skin.
Materials: Provided: Bicycle Wheel
Needed: Office Chair that turns completely around.
Optional: Stand with s-hook on hanging chain (provided)

Procedures:

Real Time:

1. Have a volunteer hold the wheel by the axles with arms fully extended. Caution the volunteer to keep the tire from rubbing on any skin or clothing.
2. Ask the volunteer to tilt the wheel (not spinning) from side to side and to remember what it feels like.
3. Get the wheel spinning as fast as you can.
4. Ask your volunteer to tilt the wheel gently from side to side, this time with it spinning.
5. Ask your volunteer to describe their experience. (The wheel is harder to tilt, as it resists a change in its axis of rotation.)

Extensions:

1. Follow the above procedure while your volunteer is sitting in a freely-turning office chair. What happens? (The chair will turn when the spinning wheel is tilted.) Try it with the wheel spinning in both directions, and with your volunteer tilting the spinning wheel to the right and to the left. What happens? Does the spin direction affect the results? Does the tilt direction affect the results?



2. Get the wheel spinning quickly. Use the eyebolt at the end of the axle to hang the wheel from the S-hook hanging from the provided stand. Hold the wheel upright so the axle is horizontal to the floor and release it. What happens? (The wheel should remain nearly upright while it moves in a circle. This surprises most people.)

3. Clear visitors from a pathway on the floor several feet wide. Try to stand the wheel (not spinning) on the floor (it falls over). Start the wheel spinning and put it on the floor. It rolls across the room without falling over. When doing this activity, ask the audience whether it is easier to balance on a bicycle that is not moving, or a bicycle that is moving quickly.

Science Content/Background:

When the wheel is spinning, it has a tendency to keep spinning in the same direction and along the same axis of rotation. This is called the conservation of angular momentum. This makes it more difficult to tilt the wheel while it is spinning than while it is staying still. This also explains why the spinning wheel continues to spin upright when released on the floor instead of falling over, and also why the hanging wheel remains upright instead of falling parallel to the floor.

Heavier objects have more angular momentum, and thus a greater tendency to continue their current direction and speed of rotation. Imagine using the same size wheel with the tire filled with air versus concrete. The concrete wheel is harder to start spinning, but once it is started, it has a stronger tendency to continue rotating the same way.

Gyroscopes are used to keep airplanes, boat, and some rockets “on course” when they are set on automatic pilot. Because they are spinning, gyroscopes resist a change in rotation.

Related Activities: Spinning Record Pendulum

