



Great Red Spot Pinwheel

Middle grades

Lesson Summary

Students create a model of Jupiter's Red Spot, rotating like a pinwheel around a central point to demonstrate the atmospheric dynamics of the cyclonic storm.

Prior Knowledge & Skills

- Planetary atmospheres

AAAS Science Benchmarks

The Physical Setting

Motion

Energy transformations

NSES Science Standards

- **Physical science:** Motions and forces, Transfer of energy

Teaching Time: One 45-minute period

Materials

Each group needs:

- Long rope or stick

Advanced Planning

Preparation Time: 20 minutes

1. Gather materials
2. Identify suitable location
3. Review lesson plan

Why Should We Care?

The Great Red Spot, a swirling storm wider than the Earth and with winds blowing 250 miles per hour, has been around for at least 300 years. The Red Spot is known as an “anti-cyclonic” storm, meaning that it is at higher pressure than its surroundings and rotates counterclockwise, against the direction of the planet's rotation. What created the Great Red Spot and why has it persisted for so long? Scientists are still working to find out.

Suggested background reading

Jupiter's storms are like Earth's

Jupiter data sheet

Source: Galileo K-12 Educator's Resources, Project Galileo, NASA/JPL

Great Red Spot Pinwheel

Materials used: Great Red Spot rotation "blink" movie (optional), available at <http://www.jpl.nasa.gov/galileo/ganymede/092396.html>

Grade level: Junior High

Background: The Great Red Spot is an intriguing, gigantic, cyclonic storm on Jupiter that has lasted for at least 300 years. It looks similar to Earth's hurricanes but is much larger -- two Earths would fit inside that storm! Also, while Earth's storms get their energy from the Sun and are much shorter lived, Jupiter's storms are mainly driven by the heat coming from within the planet.

This activity can be used in a math context (measuring speed), or a science context (atmospheric dynamics -- understanding that there's lots of interaction going on within the Great Red Spot system). Or, it can simply be used to illustrate that we can understand what we see and represent in an understandable way (in this case, by experiencing what it might be like to *be* the Great Red Spot).

Activity description: If possible, show the Great Red Spot rotation movie and/or complete the Great Red Spot rotation speed exercise. Where is the storm rotating the fastest? The slowest? Does it all rotate in the same direction?

It takes 6 days for the Great Red Spot to make one rotation. Assuming that each part of the storm takes the same amount of time to rotate (which isn't quite true), the outer part of the storm must travel faster because it must travel farther in those 6 days.

Have some students (6-8 or so) stand in a line and have them rotate like a pinwheel (representing a "slice" or "spoke" of the storm). To keep them in a straight line, have them hold hands or onto a rope or a long stick -- or have them slowly take one step at a time and make sure they are in a line after each step. Either way, students will quickly realize that those on the outside must take bigger steps (hence traveling a greater distance for each unit of time, which in the second case is one "step" command).

Who is moving the fastest? The slowest? Add another line of students like a spoke and have them continue rotating. What happens? What if there are 3 or 4 lines of students rotating? What if you represent the whole storm (like a crowded skating rink)?

Students will start bumping into each other, especially on the outside where they must move faster. This is representative of what happens in cyclonic storms like

the Great Red Spot. For further discussion, make the storm move faster or slower and notice the frequency with which students bump into each other.

This activity can lead to a number of spin-off discussions about atmospheric dynamics, rotation speed, and the difficulty of modeling complex, dynamic activity. (Think about how complex it would be to mathematically represent the Great Red Spot's with an equation, or even with discrete points.)