

Tops (Gyroscopes)

Equipment

- Gyroscopes, bicycle wheels
- Tops

Objective

Data collection

- Qualitative analysis of tops and gyroscopes

Data analysis

- Describe in words and diagrams the motion of a top (fifth grade level)

Physics Concepts

- Torque, inertia and angular momentum

Conceptual (C-Level)

You are helping out in a fifth grade classroom. One of the young students is playing with a top. They want to know why it does not just fall down when it is spinning. They also want to know why it “whirls around” (the rotation axis points in different directions). You have heard that tops (aka gyroscopes) are used a lot in the real world. You would like to impart as much wisdom to this fifth grade student as possible. You are scheduled to come back in a day so you promise to have an answer for the student.

~~Play with~~ Investigate the gyroscopes provided.

- Describe the physical principles involved in the precession of a spinning object. This should be understandable to a 5th or 6th grader.
- What is nutation?

NOTE: Please take time to play with the “ice skater” and bicycle wheel demo apparatus.

Basic Lab (B-level)

Make a schematic diagram of a gyroscope (spinning wheel) and use it to label vectors (torque, angular momentum, angular velocity etc).

- Quantitatively describe precession in terms of these vector quantities.

Advanced/Extended Lab Ideas (A-level)

- Construct a top and determine what is the key to a ‘long spinner’.
- How would you design a top that spins for a really long time?
- What practical use is a gyroscope? Does it matter how fast the gyroscope is spinning?
- Can you measure precession period as a function of tilt angle?
- What might you be curious to investigate?