Euler's Disc

Introduction:

Euler's Disc is edge-rounded and polished so that the frictional force Is minimized during its rotation on the mirrored surface. The rotation continues not only because there is little friction but also because the metal disc has a large mass. A large mass increases the moment of inertia and therefore the rotational energy. The rotational energy, E_{rot}, is related to the moment of inertia, I, and the angular velocity, ω, as follows

$$E_{rot} = \frac{1}{2} I \omega^2$$

Finally, the rotation of the metal disc eventually stops because of work done by friction and air resistance. Some of the energy gets converted to sound and some to heat.

What if the center of mass does not exactly coincide with the rotational axis. Well my friend, now we have the development of torque. Friction at the point of center mass acts against the rotational axis creating torque. Watch the movement across the 3 axles as it spins.

Materials:

- ✓ Mirrored surface
- ✓ Metallic disc
- ✓ Rattleback (plastic thing)
- ✓ stopwatch

Background Research:

1. Define the Following Terms:
    a. Inertia
    b. Moment of Inertia
    c. Rotational Energy:
    d. Friction
    e. Air Resistance
    f. Sound Energy
    g. Torque
    h. Translational Kinetic Energy
    i. Rotational Kinetic Energy
    j. Conservation of Energy

Scientific Inquiry:

- ➔ Get a stop watch ready.
- ➔ Spin the metal disc on the lab table surface. Record how long it spins.
- ➔ Place mirrored surface securely on a flat surface.
- ➔ Spin the metal disc on the mirrored surface and record how long it spins for.
- ➔ Does it fit in a vacuum chamber?
- ➔ Spin the rattleback on the table, record how long it spins, anything else happen? For how long?
- ➔ Spin the rattleback on the mirrored surface, record how long it spins, anything else happen? For how long?

Analysis/Conclusion

2. Explain how some of the rotational energy is converted to sound.
3. Explain how some of the rotational energy is converted to heat.
4. On which surface disc the disc and the rattleback spin for the longest time? Why?
5. What determines how much rotational energy there is?
6. Why does the disc eventually stop? The law of conservation of energy says that the energy within a system cannot be created or destroyed, so the disc did NOT simply run out of energy.