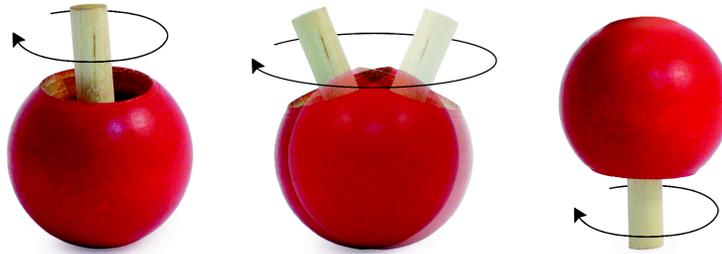


TEACHERS  
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## Inverting Pop Tops

TOP-300 / TOP-305 / TOP-330 / TOP-335



### Instructions:

With the hemispherical bottom downward, spin the stem of this top and release it onto a flat surface. The top will spin for a few moments and then mysteriously invert so that it continues spinning on its stem with the heavier hemispherical bottom lifted. Jearl Walker in *Roundabout, The Physics of Rotation in the Everyday World* (W. H. Freeman and Company) describes this top as "the most fascinating top I have ever encountered."

### Explanation:

When the top is spun, the frictional force on the hemispherical bottom causes the top to start precessing. This sliding frictional force creates a torque on the spinning mass, which causes the top to invert. A hard-boiled egg can also be used to show this phenomenon. When the egg is spun on its side, it will rise up to spin on its end.

Jearl Walker writes in the October 1979 issue of *Scientific American*:

"The motion appears to violate the law of conservation of energy because the top seems to raise its center of mass (which is in the spherical section) without outside help.

The top has long fascinated observers, including several distinguished physicists and mathematicians. In a recent paper, Richard J. Cohen of the Massachusetts Institute of Technology describes how William Thomson (the eminent physicist better known as Lord Kelvin) spent his time spinning smooth stones on the beach instead of preparing for his mathematical examination at the University of Cambridge. Later Niels Bohr, who developed the first modern model of the hydrogen atom, became similarly entranced with the mechanics of the Tippe Top."

## Take Your Lesson Further

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### **The PhiTOP** (TOP-410)

This beautifully crafted top does for angular momentum what Newton's Cradle does for linear momentum. When spun, it starts out horizontal and then, surprisingly, stands upright. Wow! In the process, it illustrates the difference between equilibrium and stability. The rise of the "center of mass" is a fascinating physics problem. It will spin for minutes on end, producing a marvelous optical illusion as it slows down.



### **Light Up Gyro Wheel** (GYR-285)

Here's a new take on a retro "toy" that mesmerizes while it teaches! Demonstrate the conversion of potential energy to kinetic energy and back again. The colorful wheel has a hidden LED light inside. As soon as the magnetic edges of the wheel touch the metal rails, the LED lights up - a perfect demo of open and closed circuits! Simply tip the rail to begin the spinning motion.

### **Wind Gyro** (TOP-380)

This elegant top can be spun by hand, but why use your fingers when you can rely on science? Simply blow a steady stream of air downward onto the top, and it will start to spin! Use a straw for more concentrated airflow, and it will keep going for as long as you continue to blow upon it. Similar to a wind or water turbine, this top is a fascinating way to teach about aerodynamic design, energy, friction, rotational inertia, and gyroscopic stability. Use it "freestyle" on your desk or set it upon its magnetic storage case and watch it go. You can even suspend the top upside down and power it using your breath! Whichever way you try, this top is an amazing demo. Approx 4 cm (1.5") tall. Colors may vary.

