

**Topics**

Balance, Energy,  
Engineering, Forces &  
Motion

**Materials**

- ✓ CDs or other round and/or cylindrical or conical objects
- ✓ Marbles or other spherical objects
- ✓ Long pointed items (wood dowels, pencils, etc.)
- ✓ Caps, craft sticks or other objects for making handles
- ✓ Tape/glue
- ✓ Scissors
- ✓ Optional: play dough, string, decorations

**Learning Standards**

NGSS: Physical Science, Forces & Motion, Potential & Kinetic Energy; Engineering, Comparing Multiple Design Solutions

# You're the Tops!

Design a Spinning Top to Investigate Motion!



Use different materials to make and test a top, observe its behavior, and then investigate how changing the design affects its motion.

**To Do and Notice**

1. **Make the Top:** Form the main body of the top with round, cylindrical, or conical items. Keep in mind that tops usually have a pointed tip on which to balance. They also tend to be narrow towards the bottom and wider near the top.
2. **Balance Point:** Install a pointy bottom using a pencil, wood dowel or similar pointed item. This part should be slightly adjustable rather than permanently fixed in place.
3. Make and install a handle for the top. This can be an extension of the point installed in step 2 or a different item. Make sure it can be grasped easily for spinning the top.
4. When finished, test the top by spinning it and observe its motion. How long does it spin? Is it stable? Does it travel across the surface? How easy/difficult is it to start spinning?
5. Create a second top, changing one variable: a different balance point, type of handle or another variable. Spin both tops and compare their motion.

**The Science Behind the Activity**

Tops/spinners have been popular children's toys throughout history, and they can be found in cultures around the world. Children learn about motion and the principles of physics by observing the behavior of their toys, learning from their own hands-on investigations. Spinning tops illustrate momentum, energy, forces and motion and balance. Some common observations:

- More massive tops can spin longer, but they are harder to get started. (**Momentum** = Mass x Velocity. If two tops are spun with the same velocity, but one top has more mass, it has more momentum, and therefore will spin longer.)
- A top having a higher initial **velocity** (faster starting speed) will spin longer.
- **Force** is needed to give **energy** to a spinning top.
- Balance is important for spinning top **stability**. A top that has a low center of mass will be more stable, while those with a high center of mass will be less stable and tend to "wobble" or show precession more radically or quickly. (**Precession** is when a spinning object's axis of rotation sweeps out a cone.)

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