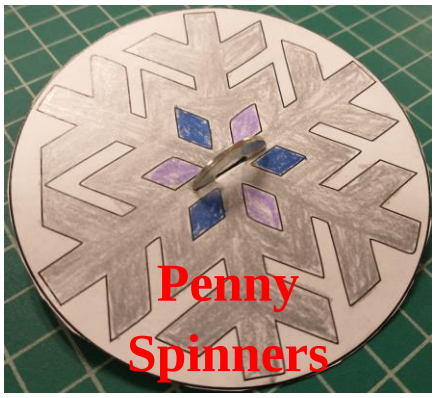
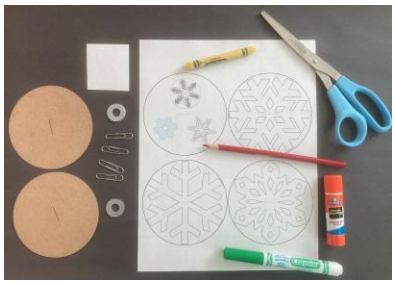


Materials:

Included in Bag:
2 Cardboard Discs
Snowflake Coloring Sheet
2- 5/16” Washer
4- Paper Clips
4 Stickers



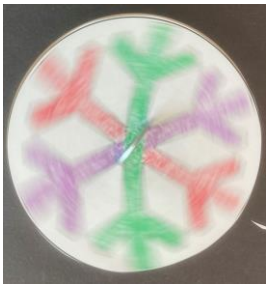
You Will also Need
Scissors
Crayons, Markers, or Colored Pencils
Glue or Glue Stick

Making and Using the Penny Spinner:

Step 1:
Color and cut out one of the snowflakes

Step 2:
Match the dotted line on the snowflake with the slit in the cardboard disc and glue the snowflake on.

Step 3:
Insert the washer, gently along the dotted line, so that it is sticking out halfway through the disc.



Step 4:
Spin the washer and observe how the spinner works.

Step 5:
Add the paper clips to the spinner. Experiment by testing different numbers and locations until you find the best spinner. What else could you try? Below are some ideas:

What's going on?

When you spin the penny spinner, it will stay upright for a long time before eventually beginning to wobble and finally fall back onto its side.

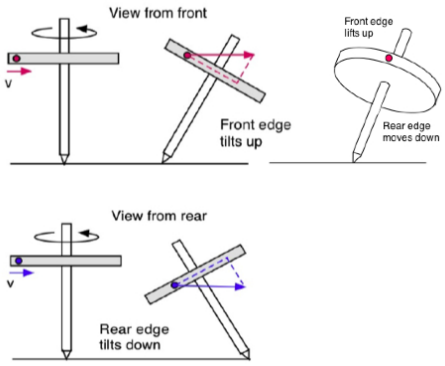
The scientific forces that make the spinner work give us a brief peek into advanced physics

Let's take a look at some of the basic forces that make the spinner work. When you put the spinner into motion, you're applying a force that gives the spinner kinetic energy, or energy of motion.

As it spins in its upright position, it rotates around an invisible vertical axis. The principle of conservation of angular momentum holds that the spinner would keep spinning indefinitely if there were no other external forces acting upon it.

But the spinners are never perfectly balanced and weighted. Moreover, the surfaces they spin on aren't perfectly level either. These imperfections allow other forces, including friction and gravity, to come into play.

When it's spinning, the spinner balances on the washer. This minimizes the amount of friction generated by its contact with the surface below it. Eventually, though, friction will begin to slow the top's spin. When this occurs, the top begins to wobble, demonstrating a scientific principle called precession.



As it begins to wobble, the axis of the spinner tilts to the side, which allows the force of gravity to exert a force known as torque on the top. The effect of the torque is to create additional spin while also causing the top to precess (swing) outward. As the top's spin continues to slow, it precesses faster in an attempt to conserve its total angular momentum. This is why the wobbling gets worse right before it falls and comes to a stop.

Follow this link to watch a video on how to make your Penny Spinner:
https://vod.video.cornell.edu/media/Take+and+MakeA+Penny+Spinner/1_aq2sudfu

Cornell Center for Materials Research (CCMR) works with families to improve the quality of STEM programs. The funding from the National Science Foundation enables CCMR to provide resources for the Take and Make STEAM kit program.

You can help out by taking a short, anonymous survey using the link below:
https://cornell.ca1.qualtrics.com/jfe/form/SV_ehXj6hCQQFNaL2K