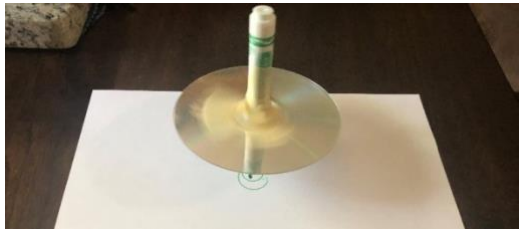
DIY Air Force Activities:

Superb Spin

Materials:

- old CDs (DVDs also work, ask an adult before you use one!)
- markers (the fat markers work better than skinny markers)
- tape (masking tape or duct tape works best)
- paper (experiment with printer paper and construction paper)



Have you ever watched an ice skater spin fast on the tip of their skates? It is almost as if they were wound up like a toy. The science behind spinning tops is the same as the science that allows a figure skater to do these amazing tricks! When you spin something, you are turning its stored energy (called potential energy) into motion energy (called kinetic energy). The force of the spin is what keeps it upright! Eventually, the object will begin to slow down, wobble and tip over. This is due to friction and gravity. The surface the object is on provides friction, which will cause it to eventually slow its spinning. As it slows, the object will begin to wobble and tilt, which allows gravity to pull it down. This is called precession. In the activity below, can you identify which parts provide friction (slows down the spinning)? What happens if you spin your marker top on different surfaces? What happens if the surface is tilted? How does the speed of your spinning marker top affect your design on the paper?

Directions:

1. Take a marker and place it through the hole in the middle of a CD (approximately ½ inch above the marker cap).
2. Tape the marker to the CD to keep it in place. Make sure the CD is as straight as possible to ensure a good spin. Try to distribute the tape evenly as well so that your top is balanced.
3. Take a smooth piece of printer paper and set it on a flat surface. Remove the cap from your marker and spin it on the piece of paper. What do you observe? How long did it spin? Repeat 3 times.
4. Now try step 3 on the rougher construction paper. Which works better? Why?

Repeat this activity, but change the position of the CD on the marker (move it higher or lower). How does this alter the results? Is there an ideal position? What happens if you use clay to modify the weight and balance of the top? A top spins about its rotation axis, which is ideally through its center of gravity (see our Balancing Act DIY). The better balanced the top is, the longer it will stay upright! Once a top becomes unbalanced, gravity has a chance to pull it down!

Air Force Associations:

The twisting force we used to set our top in motion is called torque. When the propeller of an aircraft is spinning, it produces something known as the torque effect. The propeller spins clockwise at amazing speeds. This produces a force that then causes the aircraft to experience a rotating force in the opposite direction, resulting in the plane pulling to the left! This is an example of Newton's third law, which states that for every action there is an equal and opposite reaction. Pilots must learn to compensate for this during takeoff and landing.