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The Magic of Gravity



**Introduction**
Have you ever seen a magician sweep a tablecloth quickly off a table and leave all the plates and glasses still in place? The trick isn't magic at all—it's science! And you can use the same principle (without breaking any plates) to make a coin fall into a small container.

A coin resting on a countertop isn't likely to do much—unless you or someone else does something to move it. If you give it a gentle push, which way does it go? What about if you drop it from the height of a few inches? The coin is acting the way most solid objects do—it stays at rest until you do something to it. But can you make something go where you want it to while it's at rest? Look like a magician by making a coin fall from its balancing point on top of a paper loop into a small container—with little more than gravity helping you out.

**Background**
The key to the famous tablecloth trick is also crucial to make this activity work: speed. By using one swift, smooth motion, you are overcoming the resistance of friction (the slight grip) that occurs between the paper and the coin. The quick move gives gravity a chance to overpower the friction—and demonstrate inertia.

Inertia, explained by Sir Isaac Newton and now known as Newton's First Law of Motion, says that an object at rest will stay at rest (and an object in motion will remain in motion) until acted on by another force, such as gravity—or you!

**Materials**
•    Coin
•    Bottle, jar or canister with a small top opening (larger—but not too much bigger—than the coin)
•    3- by-5-inch note card or other sturdy piece of paper
•    Scissors
•    Tape
•    Pen or pencil
•    Water (optional)

**Preparation**
•    Carefully cut the index card lengthwise into a strip about 3/4 inch wide.
•    Tape the card’s ends together and shape it into a ring that will balance on top of the container's small opening.
•    Fill the container part of the way up with water if your container is not heavy enough to be stable on its own—or if you just want to see your coin make a splash!
•    Balance the paper loop with the broad side on top of the container's opening so that the ring's open center is facing you.
•    Balance the coin on the very top of the loop—directly above the container's opening. This balancing might take a few tries, and if it is too difficult, try using a larger piece of cardstock to make a bigger loop.

**Procedure**- *Can you get the coin into the container without using your hands?*
•    Place the pen or pencil horizontally inside the loop. Slowly pull the loop off the top of the container. *What happened to the coin?*
•    Set the loop and coin back up on top of the container.
•    Now try a fast motion: insert the pen or pencil into the center of the loop and quickly pull the loop to the side (be careful with the sharp tip of the pen or pencil). *Where did the coin go this time? Did it fall closer to—or inside—the container?*
•    If the coin didn't fall into the container, observe how much closer it came than the slow push, and try it a few more times.
•    *What is the slowest you can pull the loop away and still have the coin fall into the container?*
•    *What happens when you use a bigger or smaller paper loop?*
•    Try turning this into a version of the magician's tablecloth trick. Place a flat index card over the opening of the bottle. Place a coin on top of the index card so that it is directly over the opening. As fast as you can, try sliding the index card away. *Can you get the coin to fall into the opening below?*

**Questions:**
1- Why do you think the coin acted differently when you pulled the loop off slowly and when you swiped the loop away quickly? Explain using at least 3 sentences!!

2- What is gravity?

3- What is inertia?

4- How does this demonstrate inertia and gravity? Explain using at least 3 sentences!!