

# Ta-Daa!

**Overview:** Ever wonder how magicians work their magic? This experiment is worthy of the stage with a little bit of practice on your end. If you believe in the laws of physics, particularly Newton's laws, then this experiment will work every time.

## Materials

- plastic cup
- hardcover book
- toilet paper tube
- several different objects like a ball that is smaller than the cup opening, but larger than the toilet paper tube

## Lab Time

1. Put the cup on a table and put the book on top of the cup.
2. This is the tricky part. Put the toilet paper tube upright on the book, exactly over the cup.
3. Now put the ball on top of the toilet paper tube.
4. Check again to make sure the tube and the ball are exactly over the top of the cup.
5. Now, hit the book on the side so that it moves parallel to the table. You want the book to slide quickly between the cup and the tube.
6. If it works right, the book and the tube fly in the direction you hit the book. The ball however falls straight down and into the cup.
7. If it works say TAAA DAAA!
8. Draw a diagram of your experiment right before you hit the book. Label where you expect to see Newton's three different laws in action as soon as you set things in motion:

## Reading

This experiment is all about inertia. The force of your hand got the book moving. The friction between the book and the tube (since the tube is light it has little inertia and moves easily) causes the tube to move. The ball, which has a decent amount of weight, and as such a decent amount of inertia, is not affected much by the moving tube. The ball, thanks to gravity, falls straight down and, hopefully, into the cup. Remember the old magician's trick of pulling the tablecloth and leaving everything on the table? Now you know how it's done. "Abra Inertia"!

Remember: inertia is how hard it is to get an object to change its motion, and Newton's First Law basically states that things don't want to change their motion. Once your students get good at this, invite them to try it with other objects, like unpeeled hardboiled eggs.

**Exercises** Answer the questions below:

1. What are two different pairs of forces in this experiment?
2. Explain where Newton's Three Laws of motion are observed in this experiment.

### **Answers to Exercises: Ta-Daa!**

1. What are two different pairs of forces in this experiment? (the force made by the hand and the force of gravity on the ball)
2. Explain where Newton's Three Laws of motion are observed in this experiment. (This is fun to ask the students as you walk around observing their work. Have them point out different parts of their experiment in action.)