

## 1 Overview

In most labs you will collect data and draw conclusions from that data, but this lab is different. In this lab, you will play around with a few different demonstrations in physics, and write down what you see. You will try to explain the phenomena that you observe, but at this point you will not necessarily be able to fully explain what is going on. You may end the lab session with more questions than answers—this is good!

As you play with these demonstrations, be careful to know the difference between an *observation* and an *inference*. An observation is simply what you see going on (for example, “the sky is blue”). An inference is how you explain an observation (for example, you may infer—incorrectly—that the sky is blue because it reflects the ocean).

You will be asked to make inferences in this lab. You will probably be wrong, and that’s OK! We will revisit these demonstrations throughout the class as we discover how the universe functions.

## 2 Materials

- Demonstration 1:
  - Strip of paper, folded into zig-zag
  - Something heavy, with a handle
- Demonstration 2:
  - Two balls of different sizes (for example a basket ball and a tennis ball)
  - Wide open space
- Demonstration 3:
  - Ramp
  - Two mason jars with lids (or something similar, for example two cylindrical travel mugs)

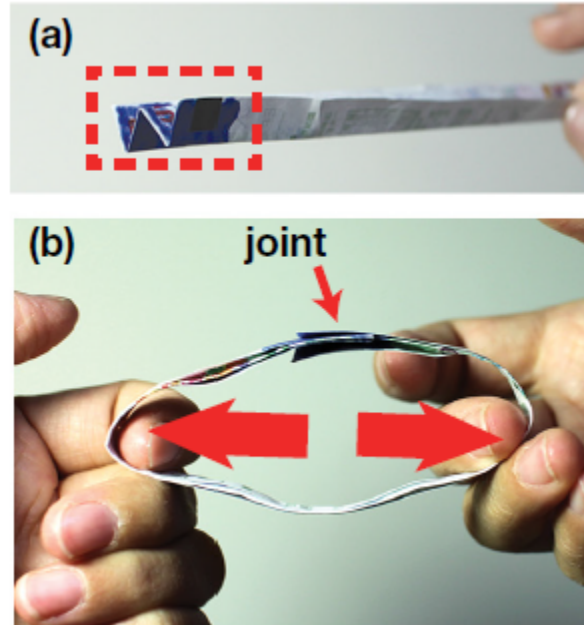


Figure 1: Paper ring for demonstration 1

### 3 Procedure

#### 3.1 Demonstration 1: Lifting a bucket with paper

Fold the paper into a zig-zag and make into a loop as shown in figure 1.

**Predict:** Can you lift the heavy object with a loop of paper? How does the amount of overlap in the loop effect the lifting? Is there a particular location on the loop that makes it easier to lift the bucket?

**Observe:** Play around and see if you can do it. Write down your observations.

**Review:** What worked, and what did not? Why did you try the things that you did?

**Infer:** What do you think explains your results?

### 3.2 Demonstration 2: Ball stack

You will want to do this in an open space, where there is nothing fragile that can be broken by flying balls. Also, be careful for your own safety! Hold the balls with the small ball resting directly on top of the larger one. Release both balls at the same time.

**Predict:** What will happen to the balls after they hit the ground? Do they both return to the same height?

**Observe:** What did you see? Is the result different if the larger ball is on top of the smaller one?

**Review:** Revisit the prediction questions—did reality differ from what you expected? If so, in what ways?

**Infer:** What do you think explains your results?

### 3.3 Demonstration 3: Ramp with two jars

Fill one jar completely, but leave the other empty. Put the lids on both jars.

**Predict:** The two jars will roll starting from the same position. Which, if any, will reach the end first? Which, if any, will be going faster when it reaches the bottom?

**Observe:** Set the jars at the same height, and gently release both from rest (do not push them). Write down your observations.

**Review:** Revisit the prediction questions—did reality differ from what you expected? If so, in what ways?

**Infer:** What do you think explains your results?