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

- Station 1:
  - Strip of paper, folded into zig-zag
  - Heavy bucket
- Station 2:
  - Differently-shaped tracks
  - Metal balls
  - Carbon paper
- Station 3:
  - Ball launch/drop apparatus

- Station 4:
  - Ramp
  - Hoop & Disk
- Station 5:
  - Basket ball, tennis ball, rubber bouncy ball, ping-pong ball
- Station 6:
  - Mystery tube

3 Procedure

You may visit the stations in any order.

3.1 Station 1: Lifting a bucket with paper

Predict: Can you lift the heavy bucket 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 Station 2: Balls and tracks

Predict: How will the different tracks affect what the balls do? Which track, if any, will take the longest time to go down? Which track, if any, will launch the ball the farthest?

Observe: Roll balls down different tracks. 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?

3.3 Station 3: Ball launch & drop

Predict: When one ball is launched forward, the other is dropped straight down. Which, if any, will hit the ground first?

Observe: Pull back on the bar, place the balls, and gently press down to release 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?

3.4   Station 4: Ramp with hoop and disk

Predict: The hoop and disk will roll start 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 hoop and the disk 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?

3.5   Station 5: Stacks of balls

Predict: Hold one ball on top of a larger ball, and let them go at the same time. They'll fall to the floor together, and the larger ball will hit the ground first. What will happen to them? Will they both rebound to the same height that you dropped them from? Will the go higher? Not as high? Will the two behave differently?

Observe: It is important that the smaller ball is centered on top of the larger one. Be aware that the balls may rebound in different directions—be careful, and be aware of your surroundings.

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?

3.6   Station 6: Mystery tube

Frequently, we are not able to directly see what is going on. A good example of this is how a magnet will pull on a piece of iron—all we can do are develop potential explanations and develop tests to see if our idea is potentially correct.

The strings inside the tube interact somehow. Play around with the tube, then make a cutaway sketch of what you think is going on inside. Remember that your model (the sketch) *must* be able to reproduce all observations in order to be a valid scientific model. Explain your process in detail.

4   Grading

You will not write a formal report for this lab. Instead, write down your notes as you followed the four-step process (predict, observe, review, infer) in stations one through five, and give the cutaway drawing with an explanation of your process from station six. Your writeup of each station will be graded out of four points, for a total of 24 points for the lab.

The writeup that you turn in must be typed, and must have your name and your lab partner's name.