Name: _____ Period: _____ Assigned on Tuesday, December 03, 2024

16.2 Lab: Ballistic Pendulum **Due Monday, December 09, 2024**

Purpose

Construct a ballistic pendulum that provides a method of measuring the height that the pendulum rises when shot by a Nerf dart.

Procedure

Using the Purpose information above, write a procedure for how the height of a ballistic pendulum can be predicted and measured.

Note: *There should be some scrap paper involved. You will likely brainstorm at least a few different ideas and need to test them before landing on a final procedure that you will submit. Take the time to come up with the best setup and procedure given your materials. You may even want to take some videos (using your phone) to determine if you need to add weight to your receptacle prior to submitting. Pay special attention to the center of mass when adding weight. Your procedure should be in bullet format or numbered and as concise as possible. Full sentences are not required.*

Diagrams

Take 2 pictures of your pendulum setup and *neatly* insert them below. Label them appropriately "Front" and "Side". Be sure to identify where (how close to the ballistic pendulum) the Nerf ejector will be held before the collision. Take pictures only once you are ready to collect the data you will use for your calculations. Do not take pictures of a test run as these usually require modifications.

Data

Create a data table to collect all of the necessary measured data from the lab

- Decide which values should be in your table, here is a list of values to get you started:
    - Mass of pendulum
    - Mass of mini dart
    - Total mass of pendulum + mini dart
    - Initial height of pendulum receptacle from base level
    - Final height of pendulum receptacle from base level
    - etc
- The table should have an appropriate title and identify the proper variable and units for each value. You do not have to use every space in the table.

Experimental Height of Ballistic Pendulum After Collision: _____

Work and Calculations

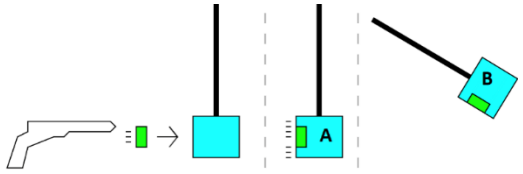

Figure 1.0 *Ballistic pendulum of dart shot from a Nerf gun*

1. Label the following blanks next to each energy situation with an A or B by referring to the labeled positions on figure 1.0 above.

PE_{min}_____ PE_{max}_____ KE_{min}_____ KE_{max}_____

2. What is the velocity of the dart before the collision (muzzle velocity)? Show your work.

3. What is the kinetic energy of the dart before the collision? Show your work.

4. What is the maximum possible kinetic energy of the pendulum with the dart immediately after the collision?

5. What is the maximum gravitational potential energy of the pendulum with the dart? Show your work.

6. What is the maximum height of the pendulum with the dart after the collision? Show your work.

7. How much mechanical energy was lost to non-conservative forces?

8. Read the paragraph and fill in the blanks with the most appropriate term.

The elastic _____energy stored in the spring of the Nerf projectile launcher is converted to the _____ energy of the dart. During the collision, the dart exchanges energy with the pendulum. After the collision, if energy is conserved, the pendulum and dart will have_____velocity than the dart before the collision. As the pendulum rises, with the dart embedded in it, it will lose_____ energy and gain _____ energy until it stops.

9. For each phase of energy conversion, describe where mechanical energy could be lost from the system.

Before collision:

During collision:

After collision as the pendulum and dart rise: