Name:_____ Date:_____

Dr. Croom's Physics Inertia Balance Lab 05-1

Inertia Balance [FORMAL LAB]

Purpose:

You are going to be given an object with an unknown mass. Without using a digital scale or a pan balance, you are going to be asked to calculate the mass of the unknown object. **Write** a purpose statement for this information that describes what the problem is you are going to try to solve. It will be something like this: "The purpose of this lab is to …"

Theory:

Write a theory (2 or 3 paragraphs cited from at least 3 different sources) that answers the following questions. The theory should be a synthesis of information not a bullet point of answers to these questions. You are looking to connect the topics not compartmentalize them. This should be done in paragraph form.

- What is Mass?
- What is Weight?
- What is a Platform / Pan balance?
- What is the difference between a scale and a balance?
- What is an inertial balance?
- Can you use a platform balance in space? Why?
- Can you an inertial balance in space? Why?
- Baron Roland von Eotvos of Hungary? What role does he play in terms of inertial mass and gravitational mass?
- What is the difference between inertial mass and gravitational mass?

Hypothesis:

In Sentence form **write** to what percent error you predict you will calculate the mass of the unknown object? Make sure to state this as a hypothesis by saying something like "The hypothesis of the researcher is that ….. ."

Materials: Inertia balances, stopwatches, c-clamps, counters, paper (to ball up to hold masses in place)

Procedure A:

1. Complete **Data Table 1** by placing different amounts of mass on the inertia balance and timing them for 20 oscillations.
   a. Pick masses near the approximate mass place them in the inertia balance tray.
   b. Secure these items in the tray with some balled up paper
   c. Displace the tray to the right or left and time 2 oscillations. An oscillation is the time for it to go from its starting position to the opposite side and back. Place your measurement in the table.
   d. Take all of the items in the tray to a balance and determine the actual mass of them. Record the measurement in the table.
   e. Divide the time by 20 and place this value in the period column of the table.
   f. Repeat for 9 more masses.

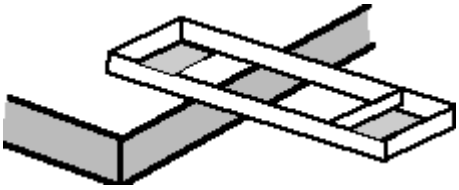

Figure 1. Inertia Balance setup.

Data Table 1. Calibration Data.

Approximate Mass (g)	Actual Mass (g)	Time for 20 oscillations (sec)	Period of oscillation (sec)
100			
200			
300			
400			
500			
600			
700			
800			
900			
1000			

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Procedure B

1. From the data collected in Procedure A construct a **calibration curve** by plotting the **mass m (y)** vs. the **period of oscillation T (x)** of the object in a scatter plot graph. This will give you an effective method of *calibrating* the inertia balance which, in essence, is a way to *predict* the mass of your unknown mass.

Procedure C

1. Place an unknown object on the inertia balance, and time it for 20 oscillations.
2. Calculate its **period** of oscillation. **Data Table 2**
3. Record its period of oscillation in the data table. **Data Table 3**
4. Use your **calibration curve** to predict the mass of the unknown. y=mx+b where "y" is mass and "x" is time.
5. Complete **Data Table 3**.

Data Table 2. Time for Unknown Quantities Oscillations.

	Time (s)
Trial 1	
Trial 2	
Trial 3	
Average =	

Data Table 3. Unknown Quantities.

Period of oscillation of the unknown =	
Predicted mass of the unknown from your calibration curve =	
Known mass as measured by the digital balance =	
% error in mass =	

Questions:

1. What would the advantage be if we had used 30, 40, or even 50 oscillations of the inertia balance instead of simply 10? In other words, why would using more oscillations be beneficial for your experiment?
2. What is the difference between a fundamental unit and a derived unit? Explain in your *own* words. Give 3 examples of each.
3. Explain the meaning of inertia in terms of Physics. Give 3 everyday examples that can be described and explained in terms of inertia.
4. What are systematic errors? Which systematic errors affected your lab trials here?

Questions/Things you need to do individually:

Complete a Formal Lab Write-up According to the syllabus provided.

1. You may share your Material, Procedure, Data, and Graphs with your lab partners. Other sections of the lab need to be your own work.
2. Answer the questions above through the lab report. There should not be a questions section of the lab. Label your answers using [#] notation.