Names: ___________________

Title:

Cart, Pulley, & Hanging Mass Lab Part 1 (aka Newton's Second Law Lab 1)

Materials:

Pasco cart, gray ramp, pulley, .1 kg masses, a single .02 kg mass, digital scale, stop watch, meter stick, cup, paper clips, string

Keep in Mind:

The instructor will demonstrate how to utilize the ramp, pulley, cart, and hanging mass. Misuse of the lab equipment automatically results in a zero on the assignment and you will be required to pay for broken equipment. Your writing must be legible.

Instructions for Experiment 1:

Hypothesis 1: Acceleration is inversely proportional to mass.

Hypothesis Test: Graph acceleration against a transformation of the mass variable (1/mass). If acceleration is inversely proportional to mass, then the graph of acceleration and 1/mass will have a linear relationship.

Detailed Instructions:

Place the .02 kg mass in the hanging cup. The Net Force on the cart is caused by the hanging mass which is its Force Gravity. You will not add additional masses to the cup during experiment 1, only to the cart. Make certain that all masses are measured in kg not grams. Calculate the Net Force or Force Gravity on the .02 kg mass below:

Use the equation $F_g = mg$ where g = - 9.8 N/kg.

$Net\ force = F_g = mg$ = (_________ kg) x (-9.8 N/kg) = ____________ N

Measure the mass of your cart using a digital scale. Do NOT begin with an empty cart. Add at least a .5 kg (aka 500 gram) mass to the cart on the ramp, otherwise the system will accelerate too rapidly to accurately measure the time it takes to travel .75 m. Make sure the hanging mass lands on something soft (e.g. a backpack). Be certain the string is not too long. Force gravity of the hanging mass should act on the cart for the entire .75 m. Report the total cart mass, added masses, and system mass below. Include the .1 kg mass hanging in the cup into the system mass.

Cart Mass: ___kg +Added Masses: ____ kg +Hanging Mass: .02 kg = System Mass: _____ kg

After you have determined the starting mass on the cart, keep the total mass constant for three trials as you measure the time it takes the cart to accelerate over a distance of .75 m beginning from rest. Students will use a stop watch to measure how much time in seconds is required for the system to travel a distance of .75 m. Repeat three times and find the average:

$t_1 =$ ________ $seconds$ $t_2 =$ ________ $seconds$ $t_3 =$ ________ $seconds$

$$t_{average} = \frac{t_1 + t_2 + t_3}{3} = \_\_\_\_\_\_\_\_ \quad seconds$$

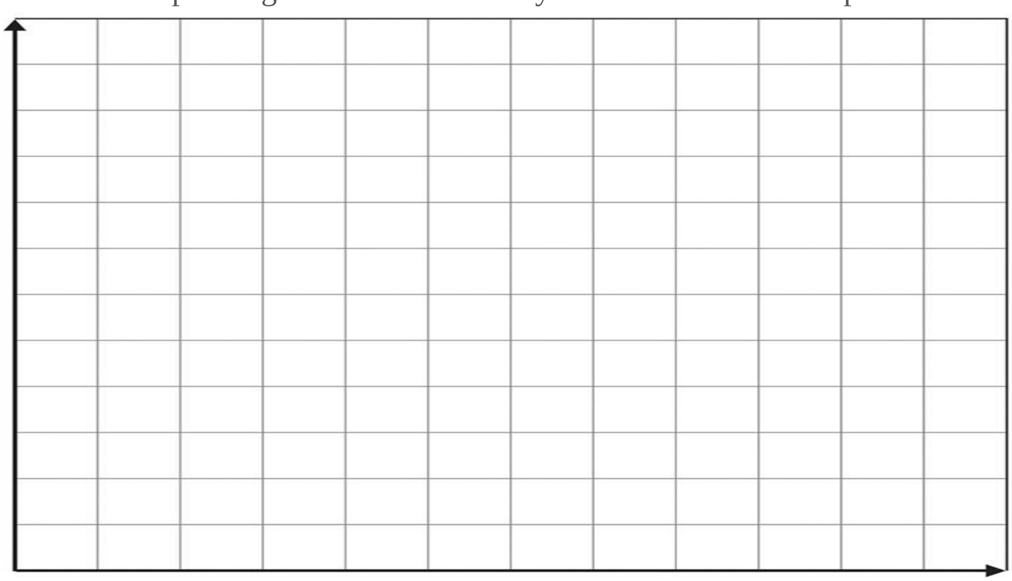
After completing the three trials and finding average time, add an additional .1 kg mass to the cart (NOT to the hanging cup) and again perform three timed trials. Repeat the process five times. Substitute the average time as ‘t’ in the following equation to calculate acceleration:

$\Delta x = v_i t + \frac{1}{2}\bar{a}t^2$ where $v_i = 0\frac{m}{s}$ and $\Delta x = .75$ m (or $d = \frac{1}{2}\bar{a}t^2$ where d = .75 m)

Report the system mass, reciprocal mass, average time, and acceleration in the table:

Scenario	System Mass (kg)	$\frac{1}{System\ Mass}$	Avg.Time (seconds)	Avg. Acceleration (m/s/s)
1				
2				
3				
4				
5				
6				

After organizing the data in the above table, graph the reciprocal of system mass on the x-axis with the corresponding acceleration on the y-axis to create a scatterplot.



Experiment 1 Questions:

1. Draw a line of best fit through the points; use an online regression applet (link is below) or ti-84 calculator to find the slope of the best fit line. What is significance is of the slope of the graph? Compare your slope to the Net Force on the cart.

2. What is the relationship between 1/(system mass) and acceleration?

3. What do your result suggest about the correctness of the hypothesis? Is it confirmed or rejected? Restate the hypothesis in your answer.

4. List at least two control variables.

5. What are some potential sources of error in your data?