Does Mass Affect Acceleration?

In the last lab, you learned that the acceleration of the cart should be reasonable close to . However, while you changed the angle of the incline, you did not change the mass of the cart. How does mass affect the acceleration of the cart? In this lab, you are going confirm or dispel any misconceptions on the affects of mass on acceleration.

To LabPro

Photogate

Gate



θ

To LabPro

objectives

* Use two photogates to measure the time and acceleration for a dynamics cart as it rolls from rest using a variety of masses on an incline plane.
* To determine the affect of mass on acceleration.

Materials

|  |  |
| --- | --- |
| Power Macintosh or Windows PC | 2 - Vernier Photogates |
| LabPro or Universal Lab Interface | Graphical Analysis software or graph paper |
| Logger *Pro* | 2.2m Pascoe Dynamics Track |
| Pascar Dynamics Cart |  |

Preliminary questions

1. How do you think the acceleration of the cart will change as more mass is added to it?

Procedure:

1. Connect the Photogates to DIG/SONIC 1 and DIG/SONIC 2 of the LabPro.
2. Place the photogate plugged into DIG/SONIC 1 at the 50cm mark on the track, and place the photogate plugged into DIG/SONIC 2 at the 200cm mark on the incline.
3. Start LoggerPro 3.5.0 or higher, and open the file “**Acceleration Down an Incline #2.cmbl**” in the student assignments directory under ***RCK Student Common I:\Assignments\Mr. Ropes\Physics***.
4. With the gate positioned in the center of the car, measure and record its width in centimeters, and record this value in LoggerPro.
5. Adjust the dynamics track so that it makes an angle of about 3-5 degrees with the horizontal.
6. Place the cart along the track so that the ***leading edge*** of the cart’s gate is at the 50 cm positon where photogate #1 is placed. Release the cart from rest, then measure and record the time it takes to descend the track and get to the second photogate. Repeat this measurement two more times.
7. Add a 250g mass to the cart and repeat.
8. Continue steps 7 and 8 until you have 1000g in the cart.

Data Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Added Mass to Cart  (g) | Mass of Cart  (g) | Time to Descend Track | | | |  |
| trial 1  (s) | trial 2  (s) | trial 3  (s) | Avg Time  (s) | Average Acceleration  (m/s2) |
| 0 |  |  |  |  |  |  |
| 250 |  |  |  |  |  |  |
| 500 |  |  |  |  |  |  |
| 750 |  |  |  |  |  |  |
| 1000 |  |  |  |  |  |  |

Data Summary & Analysis:

1. From your data, determine the average acceleration of the cart for each set of trials at each position. ***You must show a sample calculation in your lab book.***
2. Plot your value for mass vs. the acceleration of the cart for each trial and draw your best fit line.
   1. Is there a trend? Explain your answer.

Error Analysis:

What were the sources of error in this labatory investigation?

Conclusion:

What does this lab tell you about the affect of mass on an object’s acceleration?