**Calculating Gravity**

**Objective:** The purpose of this experiment is to have you determine the acceleration due to gravity accurately using an inclined plane.

# **Equipment**

* A track.
* Toy cart.
* Two Photo gates.
* A Hanging Mass
* A String
* Computer to connect the photo gates.
* Meter stick.

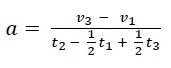
# **Procedure**

1. Prepare the timer by connecting the photo gates to the computer.
2. Prepare the track. Carefully set the track horizontal and attach the string to the cart and a hanger.
3. Weight the cart with the string and the hanging mass.
4. Place the cart in one extreme of the track and then drop the hanging mass and record

The hanging masses

T1: time for the tab on the cart to pass through the first photogate)   
T2: time between the start of t1 and the start of t3

T3: time for the tab on the cart to pass through the second photogate.  
Repeat 4 more times with the same hanging mass.

1. Calculate V1 and V3 with respect to the Length of Tab and T1 or T3 (i.e. V1= Length of Tab / T1 and V3 = Length of Tab / T3).
2. Calculate the acceleration for the runs with the formula
3. Take the average and standard deviation of the accelerations that you got.
4. Repeat steps 2 – 6 four more times, each time by changing the Hanging mass.
5. Create one (X, Y) Scatter graph with the average accelerations and height got from the lightweight cart and another for the heavy cart.
6. Add a trendline to the graphs and show its function.
7. Calculate the slope assuming that A=(G\*m)/M (A = Acceleration, G = gravity, m = hanging mass and M = Total Mass).
8. Calculate the percentage error where %Error = (Measured – Expected)/Expected

**Data**

|  |  |  |
| --- | --- | --- |
|  | **Cart on an Incline** |  |
|  | Hanging mass (g) | a (cm/s2) |
| Trial 1: | 30.0 | 56.2 |
| Trial 2: | 35.0 | 65.9 |
| Trial 3: | 40.0 | 75.4 |
| Trial 4: | 45.0 | 85.4 |
| Trial 5: | 50.0 | 94.8 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Calculations** |  |  |  |
|  | Expected Acceleration |  |  |  |
|  | Hanging mass (g) | Gravity cm/s2 | Total Mass (g) | a (cm/s2) |
| Trial 1: | 30.0 | 980.6 | 486.4 | 60.5 |
| Trial 2: | 35.0 | 980.6 | 486.4 | 70.6 |
| Trial 3: | 40.0 | 980.6 | 486.4 | 80.6 |
| Trial 4: | 45.0 | 980.6 | 486.4 | 90.7 |
| Trial 5: | 50.0 | 980.6 | 486.4 | 100.8 |

|  |  |
| --- | --- |
| **Percent Error :** | -4.1% |

**Results:**

What was the expected value of the slope, with units?

1. What was the measured value of the slope, with units?
2. 1.9 m/(g\*s^2)
3. What was the percent error between the expected and measured slope?
4. -4.1%
5. Does the data show that increasing the hanging mass increased the overall acceleration?
6. Yes
7. The uncertainty in the slope works out to be about +-0.15cm/g∙s2. What does this uncertainty tell us about the data and the procedure used to collect it?
8. That other factors like friction or software error could had happen.
9. Within uncertainty, do the measured and expected slope agree? Should this be the case?
10. Yes the slope agrees with the uncertainty.

**Conclusion :**

In conclusion, Newton’s 2nd law of motion was proved in this lab based on the

data obtained. Based on the graphs from experiment one, it can be determined that

force is proportional to acceleration based on the changes of the graph increasing and

decreasing as the mass attached to the force sensor was moved farther and closer to

the motion sensor.