AP Physics 1 Lab Handout 05 "Acceleration, Force & Mass"

Your Name:_____ Lab Partner(s):_____

Purpose: To determine how acceleration varies with changes in force and mass.

Materials:

| | | |
|---|---|---|
| 1 m string | linear motion track | dynamics car |
| rotary motion probe | mass hanger | mass set |
| 4 popsicle sticks | Lab Pro Interface | computer |
| crash pad | balance | level |
| | C-clamps (1 large, 2 small) | |

Procedure: Part 1: Set Up

1. Set up and level the linear motion track with dynamics car, 1 m string, mass hanger, rotary motion probe, 4 popsicle sticks, 3 C-clamps, and a crash pad.
2. Connect the Lab Pro Interface to the computer and rotary motion probe. Open the experiment to collect linear data from the rotary motion probe for 10 s.

Procedure: Part 2: Constant System Mass and Varying Force

3. Find the mass of the dynamics car, string and mass hanger. Record this in your data section to the nearest 0.0001 kg.
4. Position the car so the mass hanger is near the rotary motion probe pulley. Load the car with five 20 g masses for a total of 100 g.
5. Move one of the masses to the mass hanger and determine the acceleration. The slope of the line on a velocity-time graph is the average acceleration. If you think your trial was flawed by human error, you should repeat.
6. Record the total mass of the system (all the moving parts), the force on the system (each 20 g = 0.196 N) and the acceleration (the slope of the line) in your data table.
7. Repeat steps 5 and 6 for the other masses until all five masses are on the hanger.

Procedure: Part 3: Constant Force and Varying System Mass

8. In this part you will place 40 g on the hanger and change the amount of mass on the car for each of five trials.
9. Start with an empty car and add 50 g to the car for each trial. Gather and analyze data as you did in part 2 of this lab.

Results:

Observations:

Data:Mass of dynamics car, 1 m line and mass hanger:_____

Part 2:

| | hanging 20 g | hanging 40 g | hanging 60 g | hanging 80 g | hanging 100 g |
|---|---|---|---|---|---|
| Mass of System | | | | | |
| Force on System | | | | | |
| Acceleration | | | | | |

Part 3:

| | 0 g in car | 50 g in car | 100 g in car | 150 g in car | 200 g in car |
|---|---|---|---|---|---|
| Mass of System | | | | | |
| Force on System | | | | | |
| Acceleration | | | | | |

Data Analysis:

1. Using the data from part 2, plot a graph of accelerations vs. the accelerating force. Remember to place the independent variable (the one you the experimenter controlled), on the x-axis! Use Microsoft Excel to create your graph (x-y scatter plot) and make sure that the x and y axes are labeled correctly.
2. Using the data from part 3, plot a graph of accelerations vs. system mass.
3. Do a trend line analysis of both graphs.
4. Using the graphs, show the relationship, which exists, between mass, force and acceleration. Express this relationship in a simple formula.

Diagram:

Error Analysis:

Conclusion: