PHYS 1401 Lab Newton's 2nd Law

Equipment:
Air track with one glider, Electronic Mass Scale Mass-Set and Mass-Hangar,
Computer, LabPro, Smart Pulley, Vernier Logger Pro.

Introduction:
Newton's 2nd Law is the observation that the acceleration of an object is proportional to the net force acting on the object (and inversely proportional to its mass). We will investigate this proportionality in today's lab.

Track and Car:
1. Measure the mass of the glider (with end attachments) and record.
2. Place the glider on the track and adjust the level screws until the track is level.

Data Acquisition Setup:
1. Connect the Smart Pulley to the Digital Port 1 slot in the LabPro.
2. Start the computer and then open the *Vernier Logger Pro* program. Open the file "Newton's 2nd Law"

Experiment: Total Mass Constant
1. Load glider with ten 5 gram masses, half on each side.
2. Connect the string to the Car and hang the empty Mass Hangar (5 g) plus one 5 gram mass (the 11th) over the pulley.
3. Start the data recording. Release the glider and catch toward the end of its run. Find the acceleration of the glider from the slope of the velocity vs time graph displayed on the Logger Pro screen. Repeat if necessary until you get consistent values.
4. Remove two of the 5g masses from the car (one from each side) and add to the hangar. Repeat step 4.
5. Repeat Step 5 until all masses have been transferred to the hangar.

Table 1: Total Mass Constant (Hangar Mass and Load Mass Changing)

Car Mass (as used)	Car Load	Hangar Mass	Total System Mass	x Measured Acceleration	y Hangar Weight (net force)
kg	kg	kg	kg	m/s^2	N
	0.050	0.010			
same	0.040	0.020	same		
same	0.030	0.030	same		
same	0.020	0.040	same		
same	0.010	0.050	same		
same	0	0.060	same		

Analysis of Data:

1. What is the slope of the best- fit line? Include units:_____

2. What is the meaning of this slope? What is the expected value of the slope?

   _____

3. Calculate the % difference between the measured slope and the expected value of the slope.

   The % difference between two number A and B is given by:

Graph 1: Using the data from this table plot a graph of net force vs measured acceleration, with the force plotted on the vertical. Fit the graph to a linear regression line, and display the equation of the best-fit line.
4. Describe at least one source of experimental error (other than human error) and underline how you think it affected your measured acceleration values.
Summing Up: (Assume that Newton's 2nd Law is obeyed)
1. If the net-force acting on an object is doubled then the acceleration of the object
a) is halved   b) stays the same   c) is doubled
2. A net-force F acts on a mass = M resulting in an acceleration of 2m/s/s. If the same net force acts on a mass = 2M, then the acceleration of mass 2M will be
a) 1m/s/s   b) 2m/s/s   c) 4m/s/s