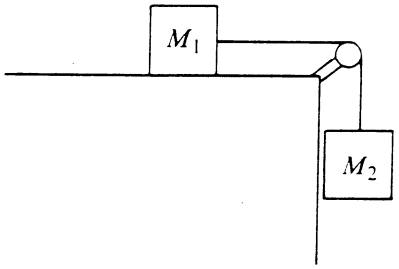
AP Physics B Name: _____
Experiment, Newton's Second Law

The purpose of this experiment is to verify Newton's Second Law, $\Sigma F = ma$. The equipment consists of a dynamics cart, M_1, placed on a low friction track and attached to a hanging mass, M_2, as shown below.



The experiment will consist of two parts. In each part, the cart will start from rest and accelerate. The acceleration will be determined with the LabPro (instructions on the back of this handout).

- First, vary the total mass by varying M_1 while keeping M_2 constant.
- Second, vary M_2 and M_1 in such a way that the total mass $M = M_1 + M_2$ remains constant.

In your write-up, please include:

(1) Title, Names, etc. (Section 1 on the handout: Lab Reports)

(2) Purpose (Section 2 on the handout: Lab Reports)

(3) Method (Section 3 on the handout: Lab Reports)

(4) Data (Section 4 on the handout: Lab Reports)

(5) Analysis (Section 5 on the handout: Lab Reports)
- Sketch a free body diagram for each of the masses.
- For Part 1, graph the acceleration versus the reciprocal of the total mass (**a** vs. **1/M**).
- For Part 2, graph the acceleration versus the hanging mass M_2 (**a** vs. $\mathbf{M_2}$).
- Include an appropriate regression equation with R^2 value.

(6) Conclusion (Section 6 in the handout: Lab Reports)
Most likely, this conclusion will be more detailed than that for Galileo's Experiment. You will want to consider the following points in your conclusion:
- Explain how each of your graphs is or is not consistent with Newton's Second Law. Analyze your results thoroughly.
- Discuss the physical meaning of the slope and intercept values from each of your graphs. If any of these values relate to a known quantity, find a percent error.
- Are there factors in this experiment that you implicitly assumed were negligible? Does your data demonstrate that this was a reasonable assumption?

You may handwrite any equations and drawings that are part of your report, if you prefer.

Using the LabPro/83 with the Smart Pulley

Note: The ENTER key on your calculator allows you to select options and run programs.

1. Attach the smart pulley cable to the adapter.

2. Plug the smart pulley into digital channel 1 on the LabPro.

3. Attach the LabPro to a TI-83

4. Run the Program ACCEL.

5. Next you will need to collect data. Estimate the total length of the experiment (1-2 seconds should be fine), and select the number of revolutions you expect the pulley to complete. (1-2 should be fine for small distances)

6. After the data has been collected, you can look at a Velocity v. Time graph, calculate acceleration, repeat experiment, and quit.

7. Once you quit, the data is removed from your calculator, and your calculator is set to the most frequently used settings.