Lab: Newton's Second Law of Motion AP Physics

(Thanks to Craig Fletcher for developing many of the ideas incorporated in this lab.)

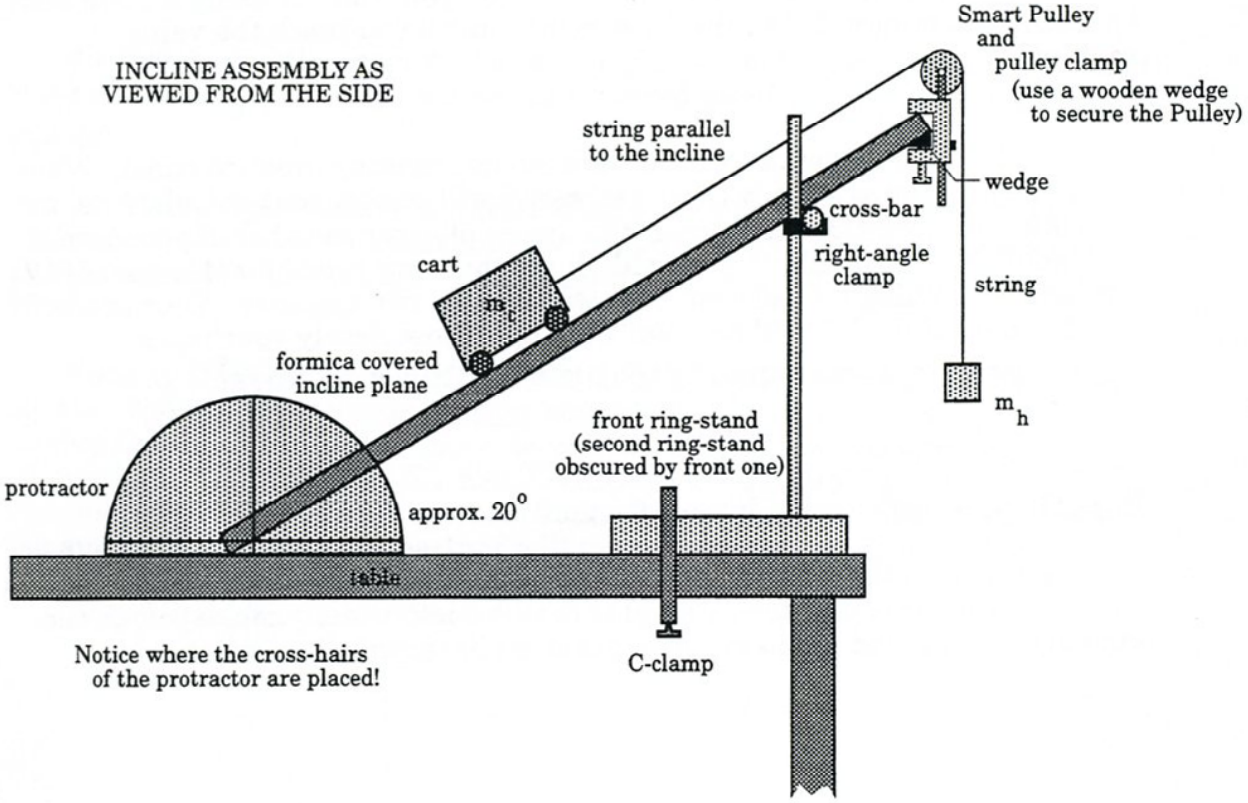
Background
Newton's Second Law of Motion, $\mathbf{F} = m\mathbf{a}$, describes the relationship between the net Force applied to a mass, and its resulting acceleration.

Objective
To examine the variables that are related in Newton's Second Law of Motion.

Equipment

Protractor or iPhone w/software	Inclined plane	Low-friction cart
String	Crossbar	2 right-angle clamps
2 ring stands	2 C-clamps	Smart Pulley & clamp
wooden wedge	set of masses	

Set-Up



Procedure
1. Derive an expression for the theoretical acceleration of the system a as a function of the hanging mass m_h, the mass of the cart m_c, and the angle of the incline θ.
2. Perform the experiment.[1] Use LoggerPro to get an appropriate Velocity-Time graph that you can use to determine the actual acceleration of your cart.

[1] Obviously, during the course of performing the lab you'll need to measure the appropriate m_c and θ values and record these in an data table.

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Questions

1. Assuming your calculation of a *theoretical* value for the hanging mass was correct, what was the percent error between your theoretical calculated acceleration and your *measured* acceleration?[2]

[2] This single question is simply a reminder that your measured value is almost certainly not in complete agreement with the calculated acceleration. As in all labs, you should determine how far off the theoretical and measured values are, comment on the difference, and include a brief discussion on any reasonable causes for the difference.