Mr. Albert (Glassboro HS) **Lab, Inclined Planes** AP Physics 1

**Simulation Link:** http://www.thephysicsaviary.com/Physics/Programs/Labs/ForcesOnInclineLab/

**General Instructions:**

- After navigating to the simulation found in the link above and clicking "Begin" you will be brought to the simulation page.
- Familiarize yourself with how to change the initial conditions of the experimental setup. You can change the coefficient of friction, the block mass, and the strength of the gravitational field. (*Not*e: The units N/kg are equivalent to $m/s^2$)
- After you "click to change angle", the angle will automatically increase. You can "click to freeze angle" to pause the simulation and examine the forces acting upon the object.

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**Part 1: Relationship between "Slip Angle" and Coefficient of Friction**

1) Describe the general experimental procedure that you must carry out to determine the relationship between the "slip" angle and the coefficient of friction. (Note: Don't say things like "click change angle.." or "click freeze the angle…" Do your best to imagine you were physically conducting this experiment when you are describing the procedure.) [If we were in person, you would DO this experiment!]

2) Carry out the experiment for a minimum of 3 different values for the coefficient of friction. Be sure to use sound experimental strategies such as repeating your data collection for multiple trials and removing outliers. Organize your data in a data table.

3) Draw a free body diagram for the object under the following circumstances… (Note: Do not include force components in your drawing.)
    a. Angle before the inclined plane reaches the "slip angle"
    b. Angle after the inclined plane reaches the "slip angle"

4) Describe what type of motion the object is exhibiting under the following circumstances. Explain how that motion relates to the free body diagram you drew in Question 3. Be sure to include a description of the relative magnitude of the forces and/or force components. If you think adding anything to your diagram in Question 3 would help, you can make another sketch here and explain why.
    a. Angle before the inclined plane reaches the "slip angle"
    b. Angle after the inclined plane reaches the "slip angle"

5) In terms of the forces/force components, describe what happens at the instant the object "slips".

6) Use your data for one of the trials to calculate an experimental value for the coefficient of static friction. Although it is given to you in the simulation, you can use the ideas you described in Question 5 to solve for your "experimental value" for the coefficient of static friction.

**Part 2: General Inclined Plane Relationships**

7) Does the mass of the object affect the angle at which the object "slips" for a fixed μ? Explain why or why not. What physical quantities are affected by an increase in mass?

8) Does the gravitational field strength affect the angle at which the object "slips" for a fixed μ? Explain why or why not. If not, what physical quantities are affected by an increase in gravitational field strength?