AP PHYSICS
IB PHYSICS

Name: _____

Period: _____ Date: _____

DEVIL PHYSICS

BADDEST CLASS ON CAMPUS

PhET Ramp Lab

(3/4 points each, 15 points total)

SETUP INSTRUCTIONS:

1. Go to the website, http://phet.colorado.edu/
2. Click on "Play with sims"
3. Under "Simulations," click on "Physics" then on "Motion".
4. Scroll down until you find the simulation "Ramp: Forces and Motion" and click on it.
5. Click on "Run Now!". It may take a while to start up.
6. Once the simulation has started, click on the folder for "Friction".
7. The default conditions for this lab are:
   $\mu_s = 0.5$ m = 100 kg
   $\mu_k = 0.3$ ramp angle $\theta = 30°$

LAB INSTRUCTIONS:

1. Draw a free-body diagram using the box to the right for a box on a wooden horizontal surface being pushed by an applied force (F_a) to the right. Be sure to label all of the forces acting on the box.

2. Using the default conditions, calculate the applied force (F_a) required to get the box to start moving on a flat surface.

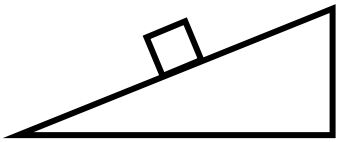
3. In the simulator, ensure the default conditions above are set. Type in the applied force you calculated above and press "Enter" without pressing the play button. Compare the approximate magnitude of the applied force vector (F_a) and the friction force vector (F_f).

4. Increase the applied force by 0.5N. Now press the play button and observe what happens. Describe what happened to the box, what happened to the relative sizes of the applied force vector (F_a) and the friction force vector (F_f) and why this occurred.

5. ***Using the default conditions*** and the applied force calculated above, calculate the acceleration of the box when the coefficient of kinetic friction applies.

Press "Reset All" and then "Yes".

6. Set position to +5 and "Enter". Do not press play. Draw a free-body diagram using the figure to the right for a box on a wooden ramp being pushed by an applied force to the right. Be sure to label all of the forces acting on the box.



7. ***Press "Reset All" and then "Yes".*** Make sure the simulator is paused and do not press "Run". Move the object position to +5 m and note the length of the F_f vector. Now change the ramp angle to 10° and note the length of the F_f vector. Why is there a difference?

8. ***Press "Play".*** Set the ramp angle to 20°. Increase the ramp angle by 1° until the box moves. Write down this angle below. What is the significance of this angle?

Press "Reset All" and then "Yes".

9. ***Using the default conditions (except coefficient of friction is 0)***, calculate the applied force (F_a) required to keep the box on the ramp without moving and *without the assistance of friction*.

10. Move the object position to +5 m. Set the applied force to the value you calculated above plus 0.5N. Set “Friction” to “Ice" (no friction). Press “Play” and note what happens (observe for at least 10 seconds). Now decrease the applied force by one N and note what happens.

11. Allow the box in the second part of the simulation in #10 to reach the horizontal part of the ramp and then continue for about two minutes. Describe what happens. Can you explain why it happens?

Press "Reset All" and then "Yes". Set position to +5.

12. ***Using the default conditions***, calculate the applied force (F_a) required to keep the box on the ramp without moving. *This time friction is in effect*. Use the simulator to check your answer.

13. ***Using the default conditions***, calculate the applied force (F_a) required to start the box moving up the ramp. *Friction is still in effect*. Use the simulator to check your answer.

14. Explain why the applied force to get the box moving is so much greater than the force required to merely hold it in place.

15. ***Using the default conditions***, now calculate the applied force (F_a) required to ***keep*** the box moving up the ramp at constant speed. Friction is still in effect. Use the simulator to check your answer.

16. Explain why the applied force to ***keep*** the box moving is less than the applied force to ***get*** the box moving.

Press "Reset All" and then "Yes". Make sure the simulator is paused. Set the object position to +8 m. All other conditions should be the default conditions

17. ***Using the current conditions***, calculate the acceleration the box will experience once the play button is pushed (i.e., the box is released).

18. ***Using the acceleration obtained above***, calculate the velocity of the box at the bottom of the ramp.

19. Calculate the deceleration of the box on the flat portion of the ramp due to friction.

20. ***Using the velocity and deceleration obtained above***, calculate how far the box will travel along the flat portion of the ramp. Check your answer with the simulator

This assignment may be typed or neatly printed. If you submit this assignment electronically, the filename must be in the following format, "LastnameFirstinitialPerXRampLab".