PHYS 101 Experiment 2. Static and Kinetic Friction on an Inclined Plane

Preliminary work:

Review Section 5.3 Friction Forces of the textbook along with Example 5.16 and Example 5.17.

Online Experiment Link:

https://ophysics.com/

Procedure:

1. Open the website given under the "Online Experiment Link". From the top menu choose the menu item "Forces", and from the appearing drop-down menu choose the experiment "Static and Kinetic Friction on an Inclined Plane".

2. Read the description given at the bottom of the page.

PART A

3. Set the "Coefficient of Kinetic Friction" parameter to $\mu_k = 0$, "Coefficient of Static Friction" parameter to $\mu_s = 0.2$, the angle of inclination parameter to $\theta = 5^o$, and the "Initial Velocity" parameter to $v_0 = 0$. If the simulation crashes giving an error message, just click OK and continue. Note that $a = 0\, m/s^2$ is written, meaning that the block does not accelerate because the component of the gravitational force $mg\sin(\theta)$ pulling the block down the inclined plane is not enough to overcome static friction. Run the simulation and verify that the block does not accelerate. Increase the angle of inclination slowly, step by step and find the value of the critical angle θ_{cr} at which the block starts to accelerate down the plane. Noting these values and by repeating the procedure for different values of the "Coefficient of Static Friction" parameter, complete the table below.

μ_s	0.2	0.4	0.6	0.8	1
θ_{cr}					

4. Check to see whether your results are consistent with the equation $F_f \leq \mu_s N$, where $N = mg\cos\theta$ is the magnitude of the normal force acting on the block, and $F_f = mg\sin\theta$ if the block is not accelerating.

PART B

5. Set the "Coefficient of Kinetic Friction" parameter to $\mu_k = 0$, "Coefficient of Static Friction" parameter to $\mu_s = 0$, the angle of inclination parameter to $\theta = 20^o$, and the "Initial Velocity" parameter to $v_0 = -1\, m/s$. Run the simulation step by step and find the maximum distance

Δx_{max} traveled by the block up the inclined plane before it starts to slide down. Repeat the procedure for different values of the initial velocity and complete the table below.

$v_0(m/s)$	-2	-3	-4	-5	-6
$\Delta x_{max}(m)$					

6. Use the table above to plot the graph of v_0^2 (on the vertical axis) versus Δx_{max} (on the horizontal axis). You should have a straight line. Calculate the slope from the graph, and using the value of the slope calculated, find the acceleration of the block on the inclined plane. Compare it with the value of the acceleration given in the simulation and calculate your percentage error.

PART C

7. Repeat Part B for $\mu_s = \mu_k = 0.2$.

8. Write a properly formatted report of your results, convert it into a PDF file and upload it to MOODLE. Deadline for submission is Monday, 20 July 2020 at 07:59 (am). Late submissions will result in deduction of 10 points for each day late.