Name: _____ Date: _____ Mr. Pecorino

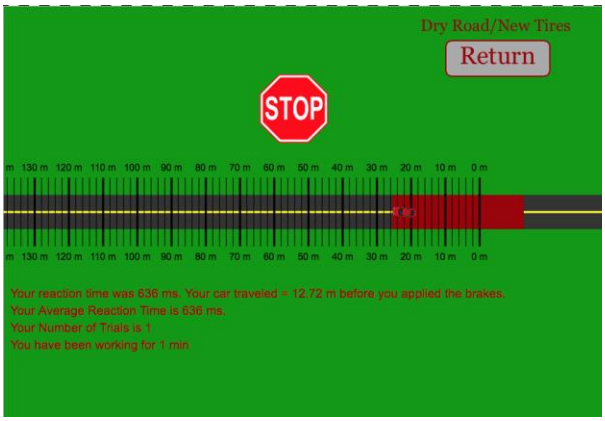
Physics Home School

Instructions: The sheet is worth a total of 20 lab pts. https://sites.google.com/site/mcculleyapphysics1/home/newton-s-laws/stopping-distance-lab Show **all** your work **hand written** on a separate piece of paper. Take a picture or scan and upload to google classroom.

(L 20& 21) Aim: How does the stopping distance depend on the speed?

Part 1 Data Collection

Set the mass of the car to 1000 kg, the road surface to dry road/new tires. Collect and record in a data table the stopping distances for 6 different speeds. Danger it is not far you traveled before hitting the brakes. You must read how far it travels from zero. In the example the stopping distance is 25.9 meters. Each division is 2 meters. In the computer simulation you can zoom in to get a better value of stopping distance.



Data Table

Speed (m/s)	Stopping Distance (m)
5	
10	
15	
20	
25	
30	

2. **Make a graph of your data.** Plot the speed as the independent variable and the stopping distance as the dependent variable. You may use the graph paper or use the computer program excel to plot the graph

2b. Base on your graph, explain how the stopping distance is related to the speed

3. Calculating the acceleration of the car.

Using the initial speed of 5 m/s and the distance equal to the stopping distance. Please note you do not know the time it takes to slow down as it is not the reaction time. Use the equations of motion to solve for the acceleration. Show the equation and substitution with units

V_I =
V_f =
a =
t =
d =

Explain why the acceleration must be negative.

4. Calculating the stopping force due to friction

Using Newton's 2nd Law $a = \frac{Fnet}{m}$ solve for F_{net} based on the acceleration from part 3 and a mass of 1000 kg. Show the equation and substitution with units

5. Calculating the coefficient of friction. The stopping force is caused by the friction with the road.

Where $F_f = \mu F_N$. Where the Friction Force = F_f = F_{net} = from part 4. The normal force F_N = m g. Solve for μ

6. Conservation of energy Solve for friction force F_f where d = stopping distance and v = initial speed of 5 m/s

Work by friction = kinetic energy

$F_f \times d = \frac{1}{2} m v^2$

How does the F_f in part 6 compare with the force in part 4.