HONORS PHYSICS **Names:**

Conservation of Energy Lab
With Hot Wheels Track

Introduction

Recall that we can define mechanical energy, E, as the sum of the potential and kinetic energies of an object or:

$$E = U_g + K + U_{sp}$$

The significance of mechanical energy is that it is conserved in systems involving only conservative forces. In situations where non-conservative forces are involved, the mechanical energy can change, as when friction causes warming by converting mechanical energy to thermal energy. When all forms of energy are considered, energy is always found to be conserved.

In this lab, you will determine, experimentally, the effective spring constant of the hot wheels track launcher.

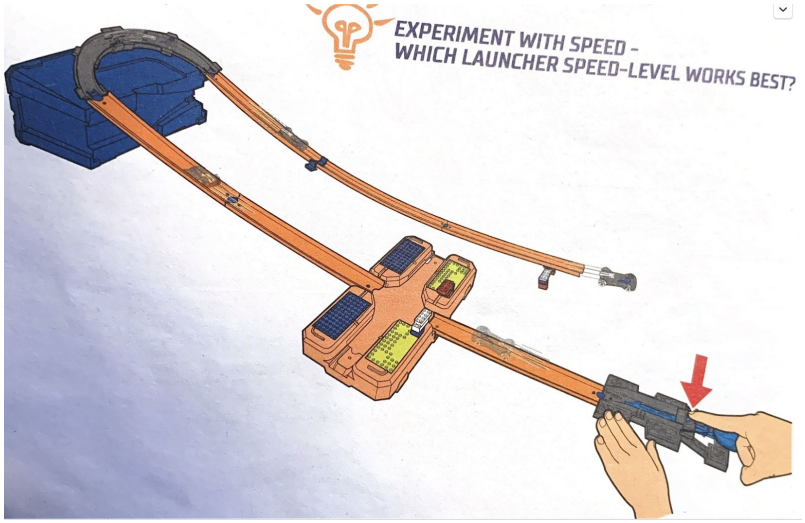
And, you will determine the coefficient of kinetic friction between the matchbox and the hot wheels track.

Materials

Hot wheels track
Matchbox
PocketLab
Meterstick
PocketLab App

Procedure

1. The hot wheels track will be set up for you as shown below.



2. Place a meterstick at the end of the ramp.
3. Measure the mass of the matchbox and PocketLab sensor.
4. Connect the PocketLab sensor to the PocketLab App on your computer.
5. Pull the launcher back per the instructions (to either groove 1, 2 or 3) and, in general, see how far the matchbox lands from the end of the ramp.
6. Replace the matchbox to its initial location in front of the launcher.
7. Begin recording data. Pull the launcher back again and release it.
8. Mark the final landing point and measure the distance from the end of the hot wheels track.
9. Save your trial data.

Data Analysis

Your challenge #1 is to calculate the effective spring constant of the launcher. There are several ways for you to calculate this, based on conservation of energy and based on the data you collected.

Show your work on white unlined paper and, at the end of your calculations, box your final answer.

Your challenge #2 is to calculate the coefficient of kinetic friction between the special matchbox and the hot wheels track. You must use data you collected, not theoretical data.

Analysis Questions

Note: You can write your answers to these questions on the same paper as your calculations.

1. Based on your calculations, does your value for the effective spring constant of the launcher seem reasonable? Justify your answer with your data.
2. How would your landing point change if you had selected a different groove to launch?
3. Based on your calculations, does your value for the coefficient of kinetic friction seem reasonable? Justify your answer with your data.
4. Using your knowledge of physics and specifically, conservation of energy, calculate the maximum range of the matchbox when it leaves the hot wheels track.
5. Consider the difference between the actual range of the matchbox and the theoretical range of the matchbox. Based on this difference, how significance do you believe to be the influence of friction? Justify your answer.