Name:

Partner:

AP Physics C
M. Lam

# Rolling Motion Lab

Block:

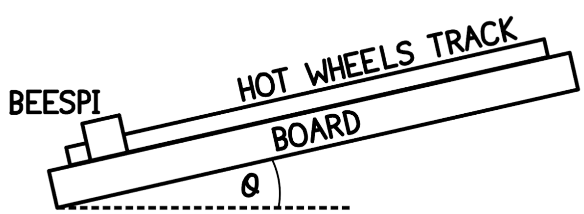
**Objective**
Determine the equation for the rotational inertia of a solid sphere

**Introduction**
1. The rotational inertia for a solid sphere, along with many other common shapes, can be modelled by the equation $I = kMR^2$ where *k* is a dimensionless constant. What is *k* for a solid uniform sphere?

2. Describe the energy transfers involved with a sphere rolling without slipping down a ramp

3. Determine the velocity as a function of height for a uniform solid sphere rolling down a ramp.

**Experimental Method**
Set up the following apparatus by securing approximately 1 m of Hot Wheels track and a BeeSpi to a wooden board.




Using a BeeSpi photogate timer, determine the value of the constant *k* in the equation for the equation $I = kMR^2$ for the rotational inertial for a uniform solid sphere. Be sure to address how experimental uncertainty could be reduced.

**Data**
Include a table of the raw data. Include all calculated data for the linearized plot.

**Analysis and Discussion**
Determine the constant equation for the rotational inertia of a solid sphere. Your report should include the following:

- A plot of the original data
- A linearized plot
- The equation of your best fit line
- The slope of your best fit line (include units)
- The equation for the rotational inertia of a uniform solid sphere including the value of the constant *k* as determined from the slope of your best fit line
- The theoretical constant *k* and percent error

| **Component** | **Criterion** | **Weight** | **Mark** |
|---|---|---|---|
| General | *Complete word-processed lab report with proper structure and formatting* | 1 | |
| Experimental Method | *Experimental method which implements a method to reduce uncertainty* | 1 | |
| Data | *Data quality and presentation* | 2 | |
| Analysis and Discussion | *Plot of the original data* | 1 | |
| | *Linearized plot* | 1 | |
| | *Slope of the linearized plot with correct units* | 1 | |
| | *Equation for the rotational inertia of a uniform solid sphere including the experimental value of the constant k* | 1 | |
| | *Theoretical value of the constant k and percent error* | 1 | |
| Conclusion | *At least two significant sources of error* | 1 | |
| TOTAL | | 10 | |